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Standard Modular Data Storage System for Maintenance Management

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This report describes the development of a Standard Modular Data Storage System. Features inventory data, pavement management data, and other maintenance data can be organized as modules in a common data repository. This repository can be imported into an enterprise database such as Informix. The use of several GIS and custom applications are described in order to demonstrate the accessibility of the data in this new format to a variety of standard management tools.

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STANDARD MODULAR DATA STORAGE SYSTEM FOR MAINTENANCE MANAGEMENT

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INTRODUCTION

Different operating and management levels in transportation hierarchies have different needs for data accessibility and, therefore, different perspectives for database management systems in the agency. A natural tendency exists for upper management to seek a comprehensive database system that provides direct access to agency-wide information. At the other end of the spectrum, individuals in operating units want specialized computer tools that are optimized to be fast, efficient and user-friendly for their specific tasks. The huge number of tasks performed in typical transportation agencies exacerbates this incongruity between centralized accessibility and distributed efficiency.

The Utah Department of Transportation (UDOT) volunteered to participate in this study, which evaluates a proposed "Standard Modular Data Storage System" that would permit the use of specific data storage modules for efficient operation, and that also would be accessible for higher level data aggregation. In particular, UDOT agreed to participate in development of a pavement management prototype that would satisfy the "centralized accessibility" and "distributed efficiency" criteria. This prototype has potential for application to smaller rural transportation agencies.

As in most transportation agencies, UDOT uses many computer tools to serve diverse maintenance management needs. Many of the tools are individually tailored for specific purposes and lack functionality to share data with other applications. This has resulted in establishment of numerous databases that are optimized for focused objectives, but are unavailable for more comprehensive management needs.

The primary objective of this study was to convert data from disparate databases into standard formats, which can be readily accessed by widely available data management tools such as Geographical Information Systems (GIS), commercial database management interfaces, and traditional programming languages. This approach provides incremental transition toward department-wide data compatibility. It

also insures that an agency will not get "locked" into proprietary software products that inhibit future modifications and enhancements by in-house or third party developers.

The specific objectives for this study are:

(1) to evaluate the extent of pavement data being stored in separate databases including the Region 1 Pavement Management System and the Features Inventory System.

(1) to decide on the record/field architecture for new database files that will be created to consolidate the systems and to convert from the current proprietary (COBOL) features inventory system.

(2) to develop new algorithms to automatically post values into the new system including supplemental geographical information..

(3) to meet with transportation maintenance personnel and ensure that the new database structures meet their needs for displaying the data using ArcView and other standard database tools.

(4) to code the software utilities for converting existing files into the new database formats.

(5) to test new software utilities and interfaces using UDOT data files.

(6) to prepare a final report including instructions for using the utilities.

This report describes development of a Standard Modular Data Storage System. Features such as inventory data, pavement management data, and other maintenance data can be organized as modules in a common data repository. This repository can be imported into an enterprise database such as Informix. Use of several GIS and custom applications are described to demonstrate accessibility of data in this new format to a variety of standard management tools.

This report has six main sections, as follows:

COBOL Database Conversion Utilities describes computer utilities created to convert data from several proprietary COBOL databases into a standard format readily accessed by widely available data management tools such as Geographical Information Systems (GIS), commercial database

management interfaces, and traditional programming languages. Guidelines for using the utilities are included.

Pavement Management Data Conversion describes procedures for converting the UDOT District 1 Pavement Management System from a Quattro Pro spreadsheet to a standardized database format compatible with the Standard Modular Data Storage System. The data previously stored in a Quatro Pro spreadsheet are now accessible as part of the new data storage system. Guidelines for using the procedure are included.

Pavement Management GIS Application describes use of ArcView to display pavement management attributes on the state route system using the Standard Data module. Guidelines for using the procedure are included.

Pavement Management Analysis Application describes use of custom applications specifically designed to access the Standard Data module and to display analytical results. Guidelines for using the procedure are included.

Summary and Recommendations summarizes the study and presents results.

Appendices include the detailed data structures for current modules in the Standard Modular Data Storage System.

COBOL DATABASE CONVERSION UTILITIES

Standard Modular Data Storage System

Computer utilities have been developed that convert data from a variety of disparate databases to a standard format readily accessed by widely available data management tools such as Geographical Information Systems (GIS), commercial database management interfaces, and traditional programming languages. This collection of databases is called the Standard Modular Data Storage System.

Figure 1 shows an overview of the data translation process. Five distinct database systems are shown. The Pavement Management system is implemented in Quattro Pro. The Features Inventory system is implemented in COBOL. The In-house Maintenance records are implemented in COBOL. The Contract Maintenance Records are implemented in Paradox. The State Highway Systems is an ArcInfo Route file. Custom utilities and, when available, standard export utilities are used to translate the databases to the standard format. This provides accessibility for all conventional analysis and developer tools such as ArcView, Delphi, C++, Visual Basic, and standard database engines. These tools can be applied to analyze and display data in ways that were impossible in their original formats. A detailed description of the custom translation utility follows.

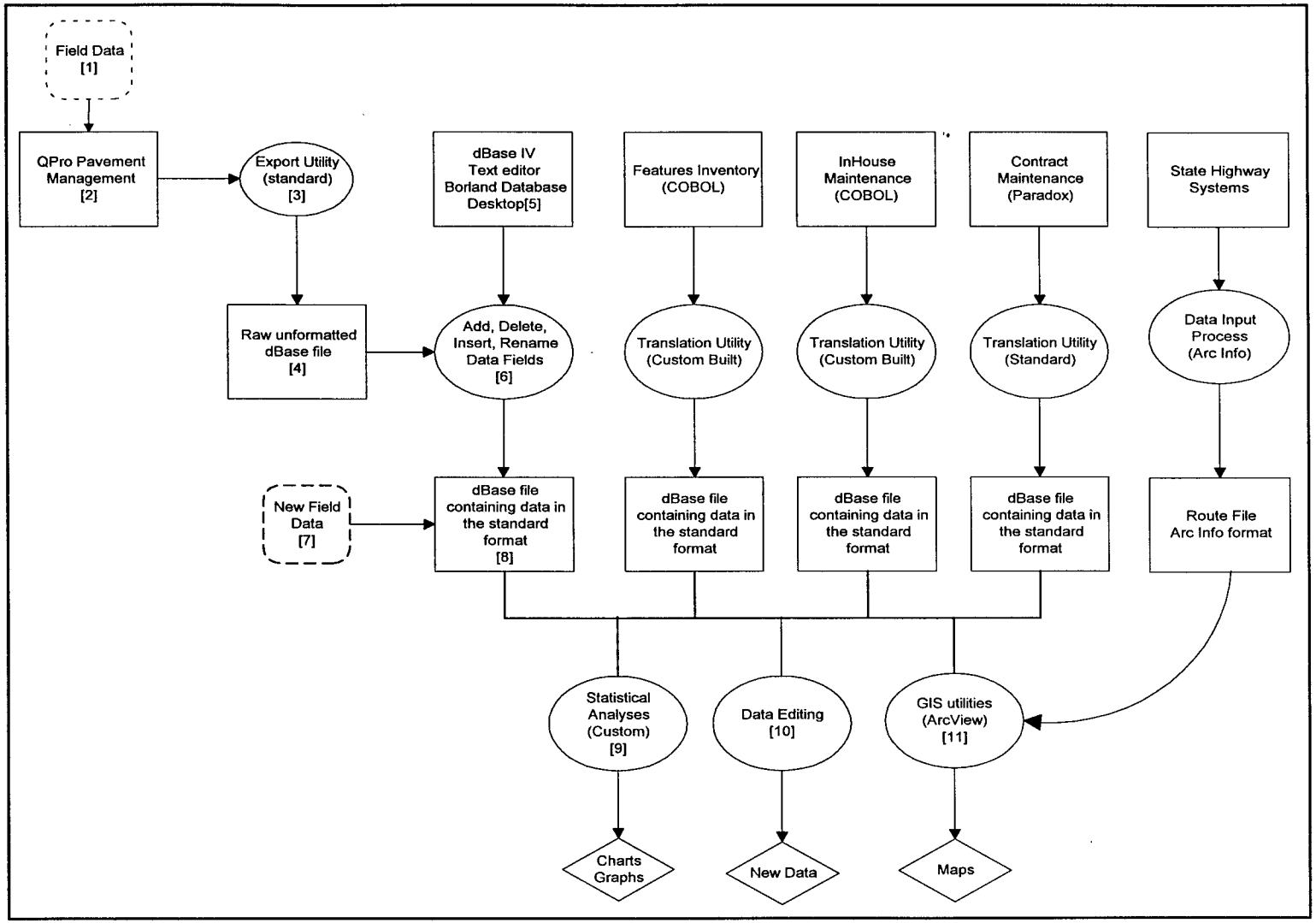
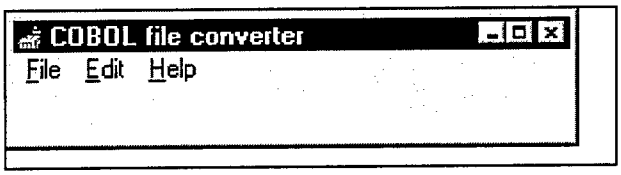


Figure 1. Standard Modular Data Storage System

Description of Utilities

Below are screen shots from the COBOL file converter and explanations of the menu functions. The opening screen is shown here.

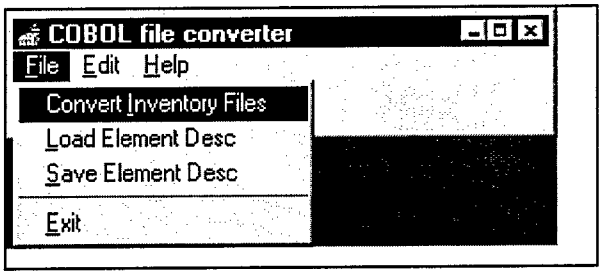
The COBOL file converter has three main types of functionality: "Converting Inventory Files," "Editing Element Descriptions," and "Making Description Dbase Files."



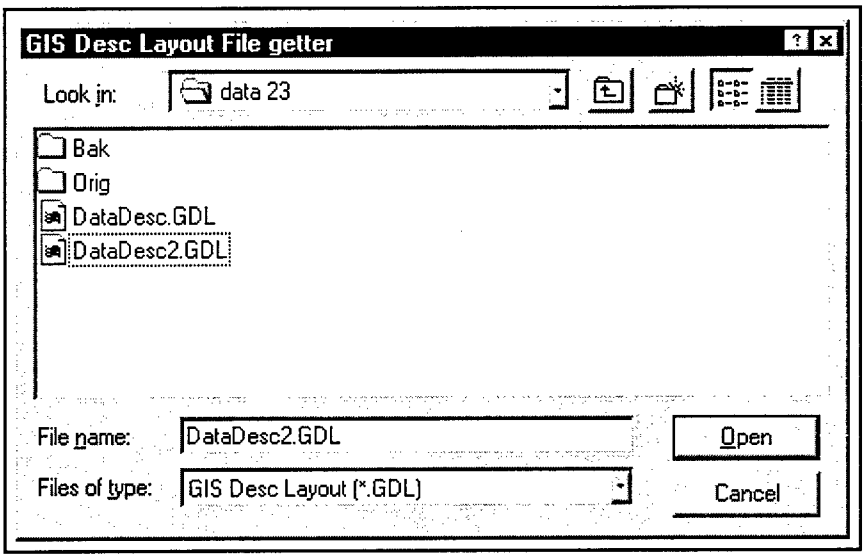
The sections below describe each type in detail.

Converting Inventory Files

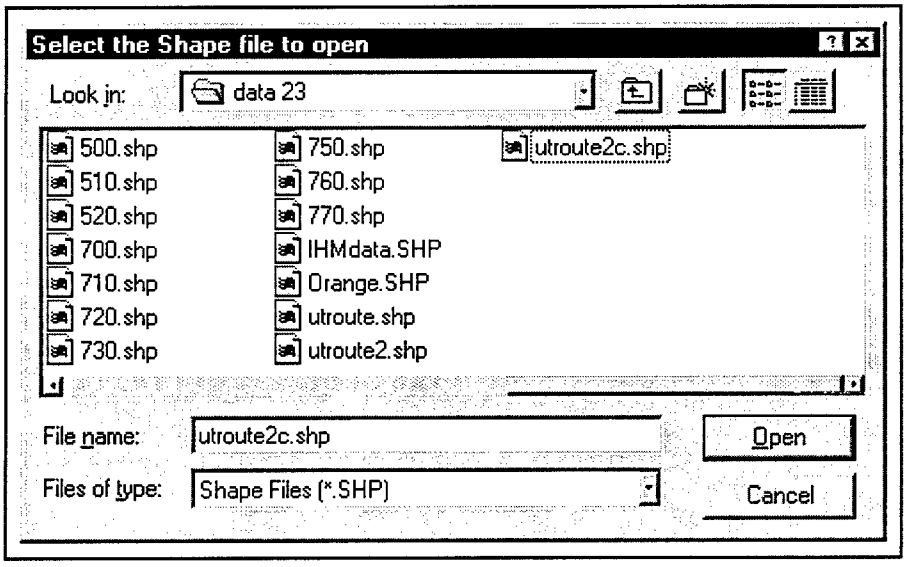
Select the File menu's submenu Convert Inventory Files.



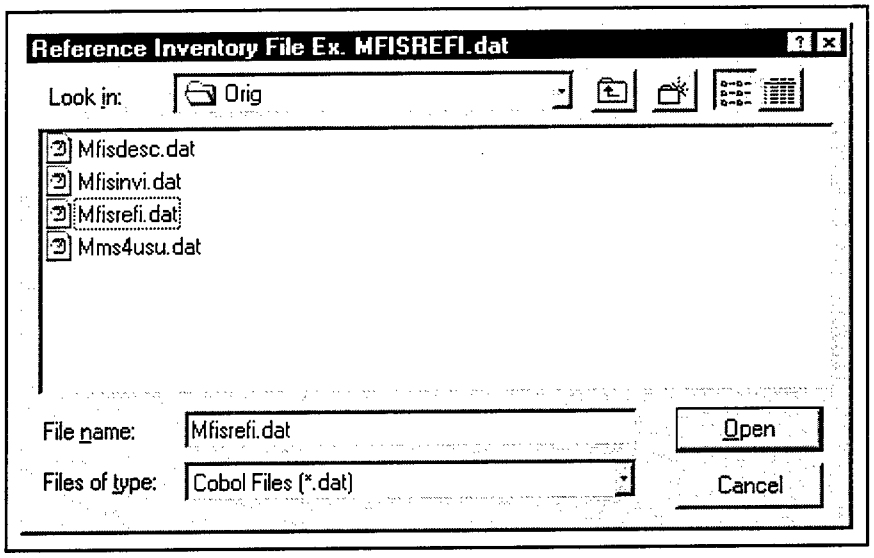
Select the description Layout file from the open dialog.



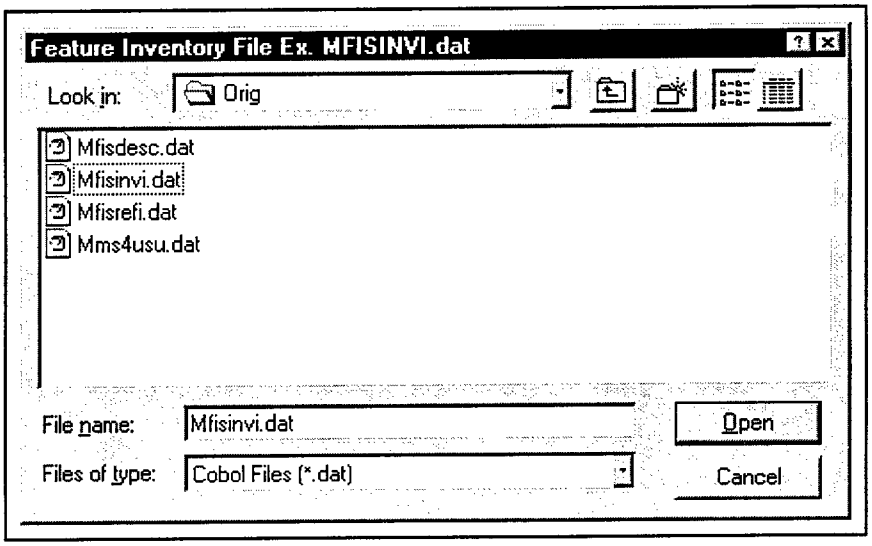
Select the route shape file from the open dialog.



Select the Inventory Reference file from the open dialog. This file is normally named "MFISREFI.DAT."

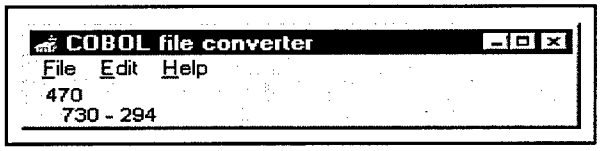


Select the Features Inventory Dialog from the open dialog. This file is normally named "MFISINVI.DAT."

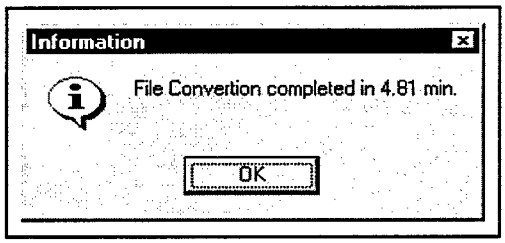


The program will begin extracting data from the COBAL file. Once all data has been extracted from the COBOL file a dBase file is created, data are stored for the element, and then, a shape file is created for that element.

Converter in the first phase of converting.

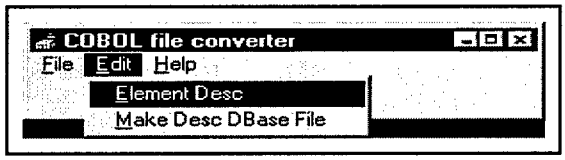


Completion dialog at the end of converting.

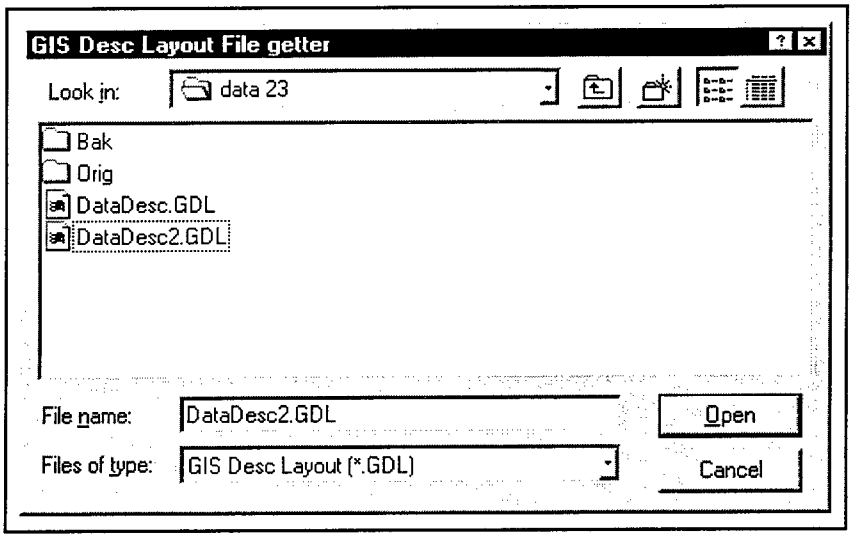


Editing Element Descriptions

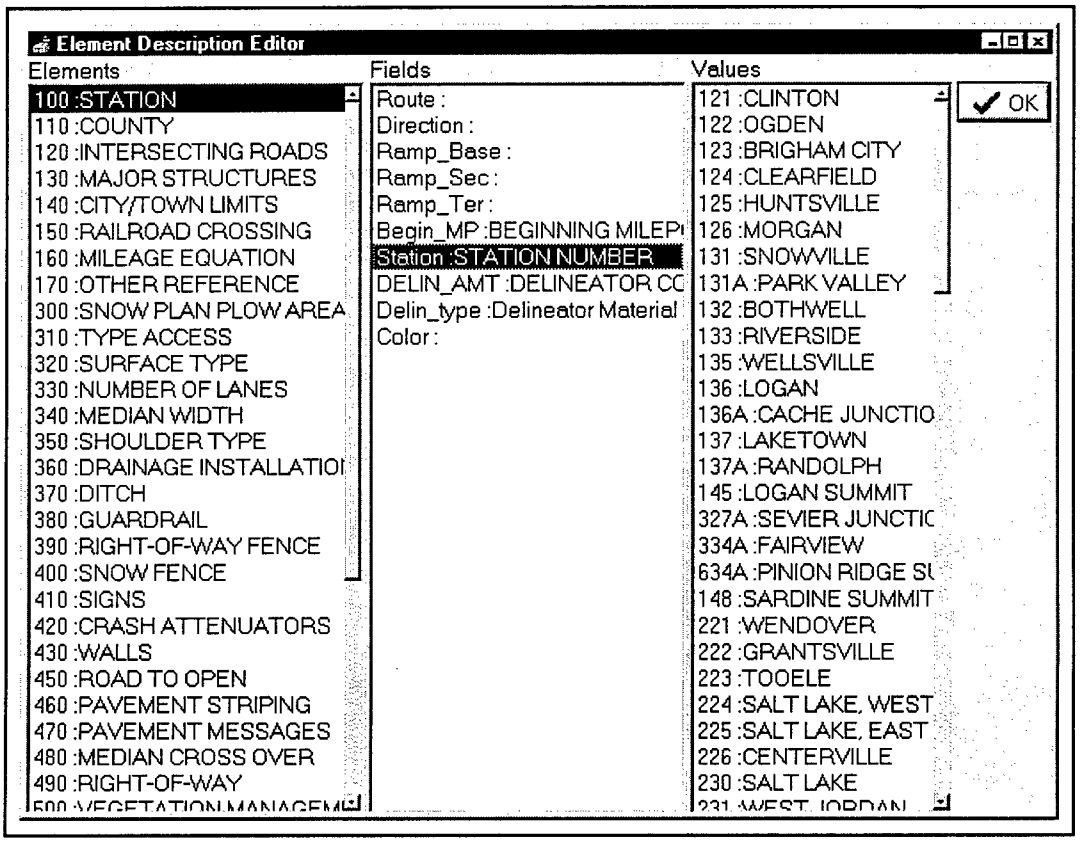
Select the Element Desc menu item under the Edit menu.



If a description file is not already loaded, you are prompted to select one. The Element Description Editor is then shown.

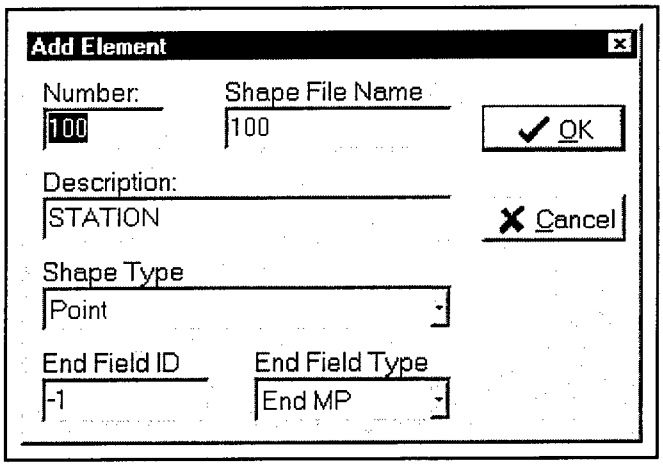


The description editor has three lists. The list to the far left contains all the elements, the middle list contains fields in the currently selected Element, and the list to the far right contains values of the currently selected field.



Right clicking on any list causes a pop-up menu to appear. This menu has three items to choose: Add, Edit and Delete. Clicking the Add menu opens the editor for the selected list with a new item. Clicking the Edit menu opens the editor for the selected list with the selected item. Clicking the Delete menu deletes the selected item in the selected list.

Element Editor

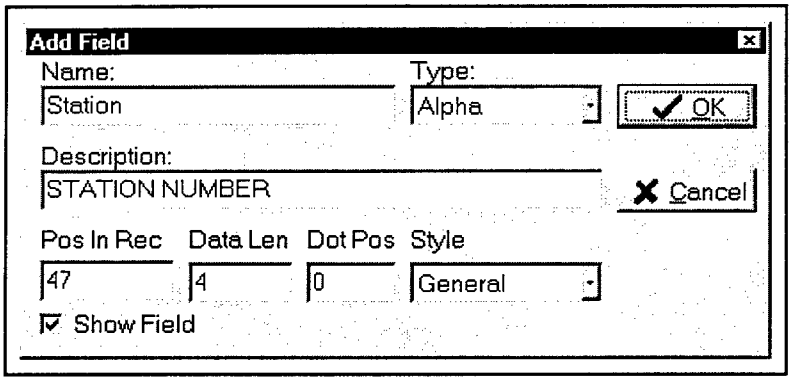


The Element editor has six fields. The first field, Number, stores a number used to represent the element in the MMS program. The Shape File Name names the shape file and dBase file for this element. The Description is the text shown when describing this element in the GIS demo program. The End Field ID is the position of the field used calculate End MP (the first field has ID 0, the second ID 1). The End Field Type is either End MP, Len in feet, or Len in miles.

Field Editor

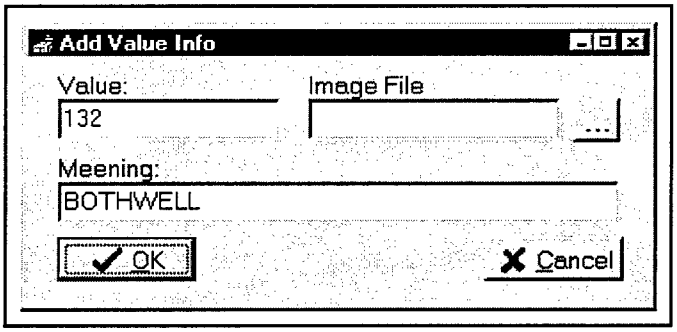
The Field editor has eight fields. The first, "Name," stores the name of the field it describes. "Type" can be Alpha, Integer, or Real. "Description" is the text shown when describing an element in the GIS demo program. "Pos In Rec" is the offset of the field's data in a COBOL file record. "Data Len" is the number of bytes that make up this field in the COBOL record. "Dot Pos" is the position in a Real type field where the decimal point is placed. "Style" should be general except when the field is one of the

special case types: e.g. "Route," "Direction," "Ramp Base," "Ramp Sec," "Ramp Ter," "Side," "Begin MP," and "End MP." "Show Field" determines if the field is listed in the GIS demo program.



Value Editor

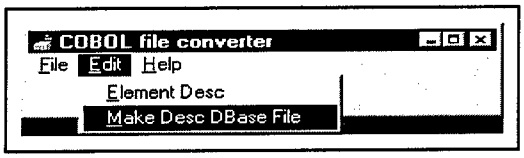
The Value editor has three fields. The first stores a value the field can have. The Image File is a bitmap that shows if the value is displayed on the map in the GIS demo program. If Image File is left blank, then it uses the default display. The Meaning is the text that shows when describing this element in the GID demo program.



To save changes made to the Element descriptions, select Save Element Desc in the File menu.

Making Description dBase Files

Select the Make Desc dBase File in the Edit menu.



A dBase file is made out of the information in the Element description file.

PAVEMENT MANAGEMENT DATA CONVERSION

Spreadsheet Structure

Personnel at UDOT District 1 have devised a Quattro Pro spreadsheet application for their pavement management needs. A spreadsheet table is created to house data collected from the field. Salient features of the data include types and history of pavement elements such as painting, sealing and surface treatments. Future appraisals for the elements were computed based on life-cycle formulae using macro functions in Quattro Pro. The spreadsheet also contains pertinent data about construction agencies, date of construction, class of road, surface area, and traffic count.

The spreadsheet contains various sections. Most of the information is in the ***Data page***, which is divided among other sheets as follows:

Paint History page — Contains data about the last paint dates and paint types, such as solvent based paint, epoxy paint, or tape paint

Surface area page — Contains surface areas of routes in a station and total surface areas for such stations

Concrete page — Details the concrete surface treatments classified as Joint reseal, Surface repair and reseal, and Major rehabilitation and reconstruction

Urban Interstate Asphalt page — Details Urban Interstate Asphalt treatments classified as Surface rejuvenation, Open grade seal, Structural overlay, and Reconstruction

Urban Asphalt page — Contains information on Urban Asphalt surface treatments classified similar to Urban Interstate Asphalt treatment

High Volume Asphalt page — Contains information about the High Volume Asphalt surface treatment and also is classified similar to Urban Interstate Asphalt treatment

Rural Interstate page — Details the Rural Interstate surface treatments further classified as Surface rejuvenation, Chip seal, Structural overlay, and Reconstruction

Low Volume Asphalt page — Details Low Volume Asphalt surface treatments classified similar to Rural Interstate treatment

The spreadsheet is organized in such a way that data pertains to segments within a route. Each route in a controlling station is broken into sections that have a beginning mile point and an ending mile point. Such a data organization lends itself well to a geo-spatial representation. The spreadsheet also includes a host of macros, which help customize data editing.

CONVERSION TO STANDARD DATA STRUCTURES

Introduction

In today's world, the manager's task may be made easier by several user-friendly, graphical interface tools that aid the decision making process. The District 1 Pavement Management spreadsheet is an efficient way to store data, however it lacks one major asset "data connectivity." The tools cannot be exploited until data are readily accessible in a standard form. Another problem to contend with is disparity in data storage. At present, UDOT uses many different applications such as COBOL, Paradox, and WordPerfect tables for its data. Porting all the applications into one standard database would entail uniformity. Keeping these factors in mind, it was suggested that one enterprise database be used to handle all of UDOT's needs. The first step in this direction was taken by converting all data into dBase format files.

This process is depicted in Figure 1, starting at the upper left of the diagram. The following numbers in parentheses relate to corresponding numbers on the diagram. Data from the field (1) was entered into the Quattro Pro spreadsheet (2). The data are exported using the standard export utility (3) to a raw unformatted dBase file (4). A standard dBase file editor (5) is used to add, delete, insert, and

rename data fields (6) to make the resulting database (8) convenient and useful. In the future, a separate data entry system (7) can be easily implemented to bypass steps (2) through (6). The resulting file in standard dBase format can be conveniently accessed for statistical analysis (9), data editing (10), and GIS displays (11). The process is described in detail in the next section.

Conversion Process

Data connectivity is best provided by a relational database structure. The spreadsheet data can be converted to standard formats using intrinsic Quattro Pro functions. The File/Save As option in Quattro Pro is invoked and the file is saved as a dBase IV file. The raw dBase file obtained has default row and column names, which must be renamed to reflect true field names for the database. Data in the existing database also presented a few problems as follows :

Missing Data : A few data fields did not contain data.

Data Inconsistencies : The Date fields were not consistently defined.

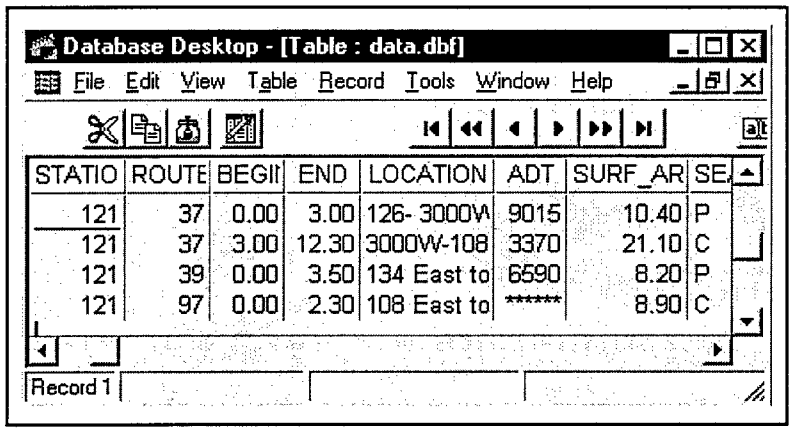
Data not Updated : In the case of a few records, the older record was not deleted when a new record was entered.

A database editor was employed to rectify anomalies in the data. Although any standard database editor could have been used, Borland's database desktop was used for this purpose. Changes that were effected include:

1. Field names were modified to better identify the data they contain.
2. Redundant data was cleaned.
3. Field types were assigned so text fields and value fields were delineated clearly.

The following screen shot shows a dBase table in the Database Desktop editor. It must be stressed that the Database Desktop editor is used merely for structuring the database. Once such a

database has been structured, data can be easily maintained using the interface described in the following section.



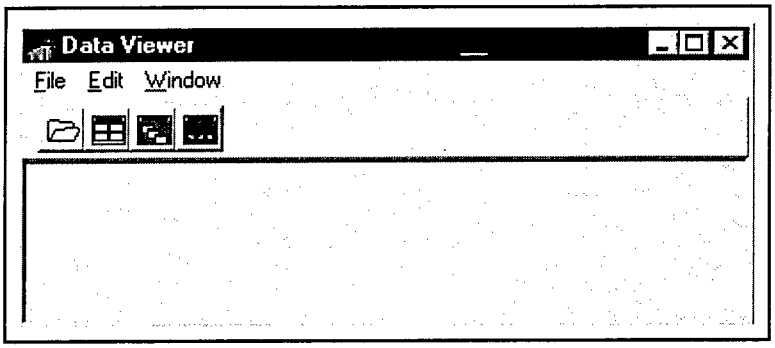
Once data are translated into standard structures, they are available for analysis by all standard developmental tools. A few custom applications were built using the standardized dBase format with C++/Delphi and ArcView. The applications focus on:

1. Data Maintenance
2. Map Generation
3. Statistical Analysis

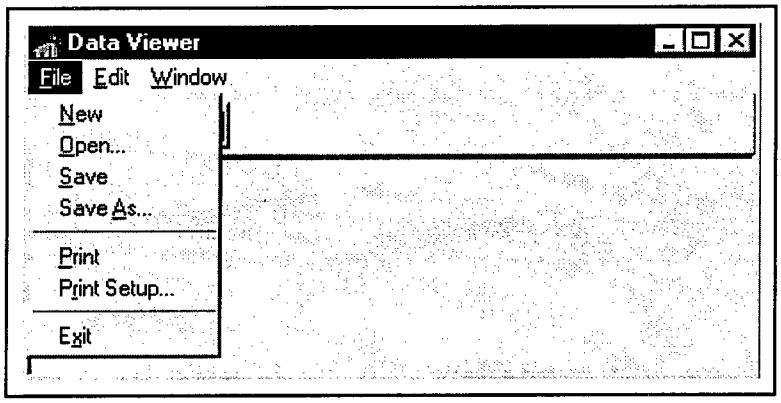
DATA MANAGEMENT

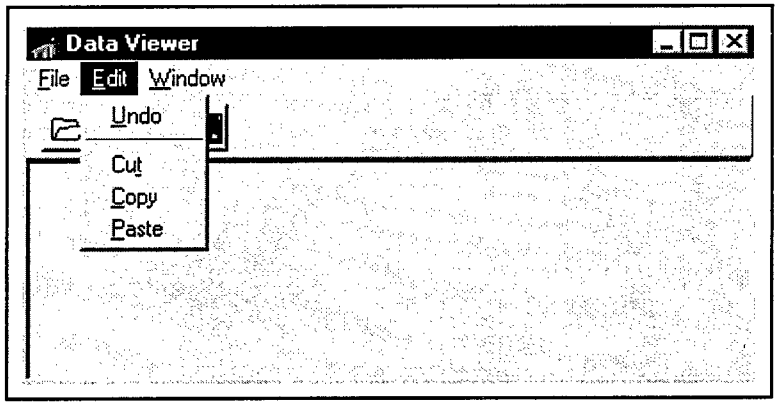
One of the pivotal tasks in Data Management is updating records. A Delphi module was created to provide a user-friendly interface for important update operations on standard data structure such as editing data values and inserting and deleting records. Menu functions for this interface are described in this section.

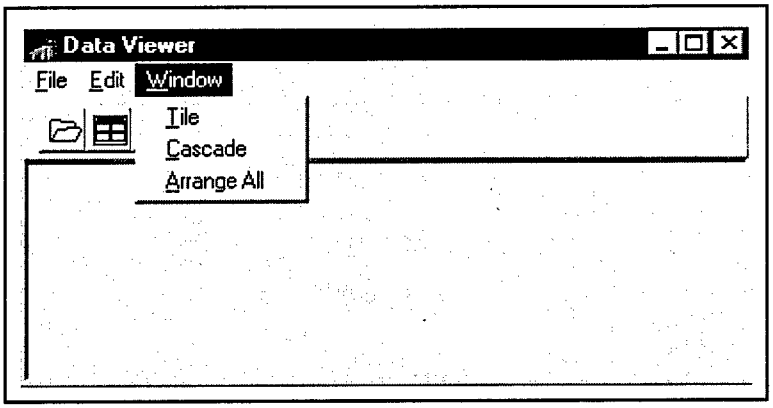
The screen shot below shows the opening screen. A few hot keys are provided. They are, starting from the left, the File open menu, window tile, window cascade and window arrange menus.



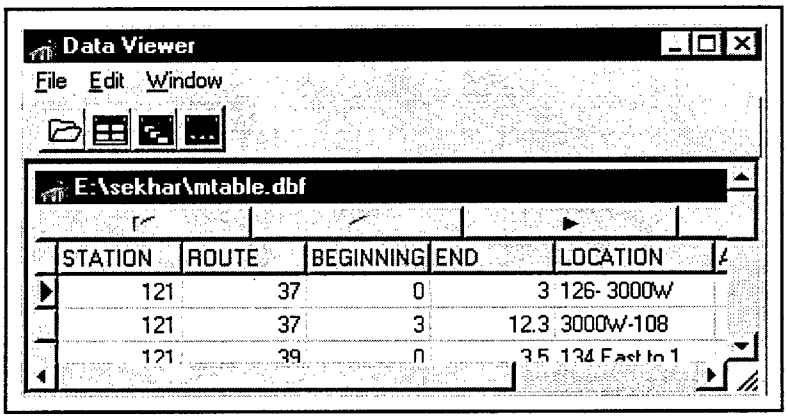
The following series of screen shots show the expanded menu options



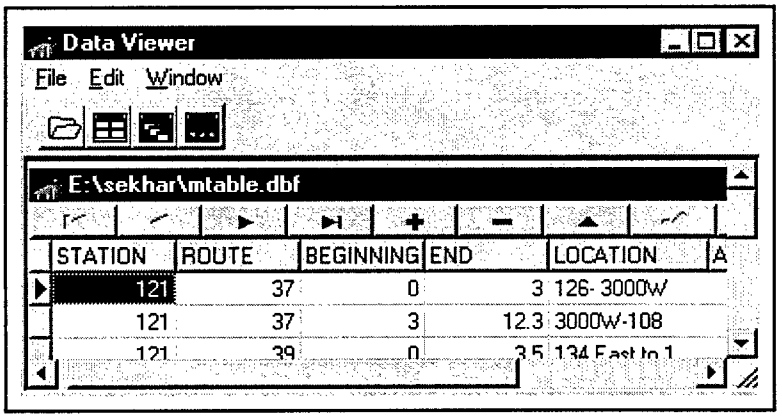




Using the File/Open option, the database table to be updated is opened in the data viewer. The screen now looks like the screen shot below.



The table is in a read-only mode now, therefore it cannot be edited.



ICON	Function	Description
	Move First	Moves to the first record in the table.
	Move Previous	Moves to the previous record in the table.
	Move Next	Moves to the next record.
	Move Last	Moves to the last record.
	Insert	Inserts a new record at the current record.
	Delete	Deletes the record that is displayed.
	Edit	Enables users to modify fields in the current record.
	Post Edit	Saves Changes to a record.
	Cancel Edit	Cancels changes to a record.
	Refresh Data	Reloads the current record.

PAVEMENT MANAGEMENT GIS APPLICATION

Introduction

A Geographic Information System (GIS) is an organized collection of computer software and geographic data designed to efficiently capture, update, manipulate, analyze and display all forms of geographically-referenced information. UDOT District 1's pavement management needs effectively can be served by a GIS. A sophisticated GIS answers the following typical questions.

Location : What is it?

This question seeks to find out what exists at a particular location, for example, the Average Daily Traffic of a particular location.

Condition : What is at?

This question is a converse of the first and requires spatial analysis. Locations where a few conditions exist can be pinpointed, such as location of rural roads.

Trends : What has changed since?

This question seeks to find the differences within an area over time. For example, the efficacy of particular surface treatment could be compared with other types.

Patterns : What are the spatial patterns?

This query is complicated in that it links quite a few components. An example would be investigation between Average Daily Traffic and expected paint life.

Modeling : What if?

These questions determine effects of a particular constraint.

In lieu of the above discussion, pavement management data translated into a standard database was integrated into a Geographical Information System. ArcView software was used for this purpose. UDOT already had a digitized map of the state road network in Arc Info. This route file is first saved as a

theme in ArcView. The pavement management dBase table is then added to the project. The table is linked to the display by adding milepoints as linear events along the view. A new theme is created in ArcView . The pavement management table serves as its attribute table. This table now can be queried to yield results that can be depicted visually on the display. Continued use of the identity option in ArcView, identifies pavement attributes for a desired road segment. The display also can be color graded to reflect different classifications of a particular data entity. For example, the expected failure dates for surface treatments could be color graded. A layout of this display can be generated using appropriate legends, which would be good for a manager who can use the map to prioritize tasks. The usefulness of map displays for management needs can not be overemphasized.

The next section provides a stepwise description of the process of translating the pavement management spreadsheet into a GIS utility.

MAP GENERATION PROCEDURES

The Quattro Pro file is saved as a dBase-IV file. The dBase table is restructured to ensure field names match those of the Quattro-pro file.

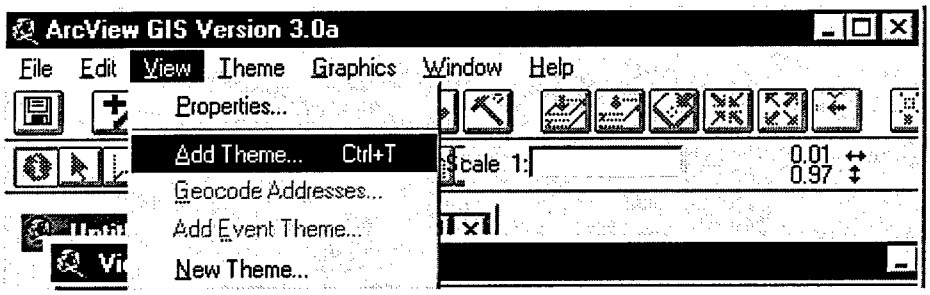
Numerical (or date fields) must be appropriately defined in the database.

Field roster:

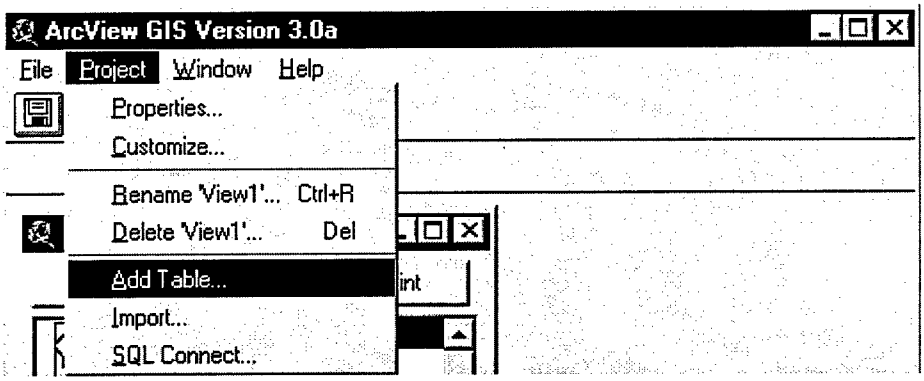
	Field Name	Type	Size	Dec
1	STATION	N	9	0
2	ROUTE	N	6	0
3	BEGINNING	N	6	2
4	END	N	6	2
5	LOCATION	C	13	
6	ADT	N	8	0
7	SURF_AREA	N	6	2
8	SEAL	C	3	
9	DATE_ACC	N	6	0
10	CONT_AGENC	C	11	
11	ROAD_CLASS	C	7	

The database was restructured using Delphi's database desktop. The above screen shot shows field definitions.

A new project is opened in ArcView. On the View window, using the add theme utility the route theme is added into the project.

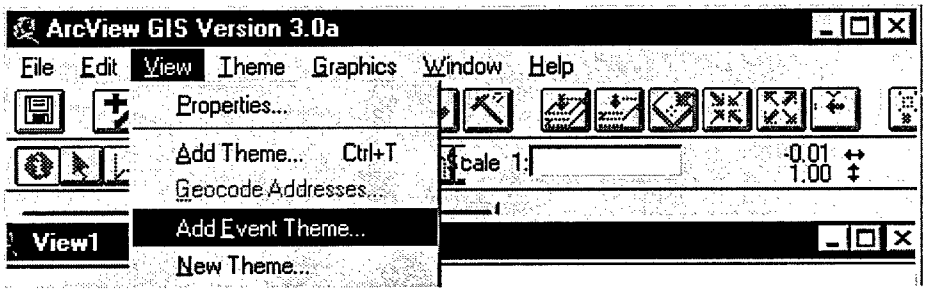


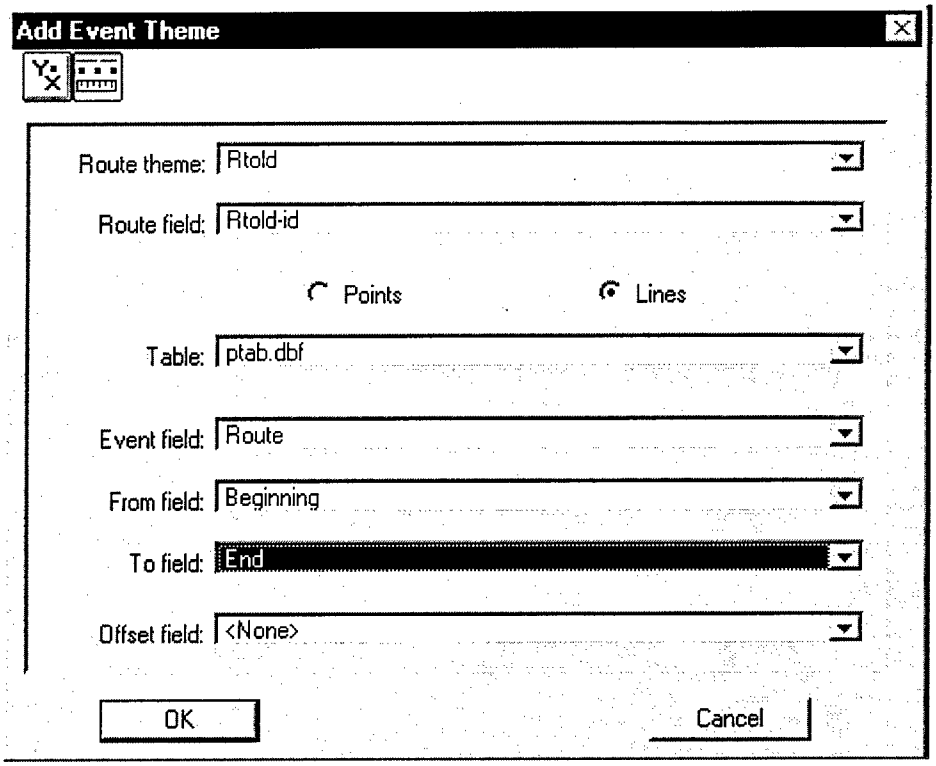
The Add Table option in the project window of ArcView is used to include the requisite dBase tables as part of the ArcView project.



The table is then linked to the display by adding the table as a linear event . The field "route-id" is the key event field and the "beginning" and "end" milepoints are the to and from fields respectively.

The following screen shots are descriptive of the process.





Care should be taken to see that the table is added as a route event. To do this, the Dynamic segmentation button, the second button on the top left of this screen shot, should be enabled.

The above process leads to creation of a new theme, the attribute table of which is the dBase table added. Various ArcView functions can be performed on this attribute table to yield results to queries and map displays.

MAPS AND DATA INTEGRATION

Exhibits 1 through 5 show maps (GIS displays) of some attributes in the Pavement Management System.

Exhibit 1: Paint Types. Shows the spatial distribution of the three paint types: epoxy, solvent-based, and tape.

Exhibit 2: Painting History. Shows the spatial distribution of the most recent year the roadway was painted.

Exhibit 3: Next Scheduled Maintenance. Shows the spatial distribution of the forecast for the next pavement surface treatment.

Exhibit 4: Types of Seals. Shows the spatial distribution of the five types of seals used by District 1.

Exhibit 5: Seal Maintenance History. Shows the spatial distribution of the history of seal maintenance.

One of the most powerful features of the Standard Modular Data Storage System is the flexibility to integrate data from multiple databases. This feature is demonstrated in Exhibit 6. Route segments in the Ogden area contained in the Pavement Management Data Module are shown in dark black. The intersecting roads feature from the Features Inventory Data Module are shown as black dots. The route segments in the Route Data Module, which are not included in the Pavement Management Data Module, are shown in light gray.

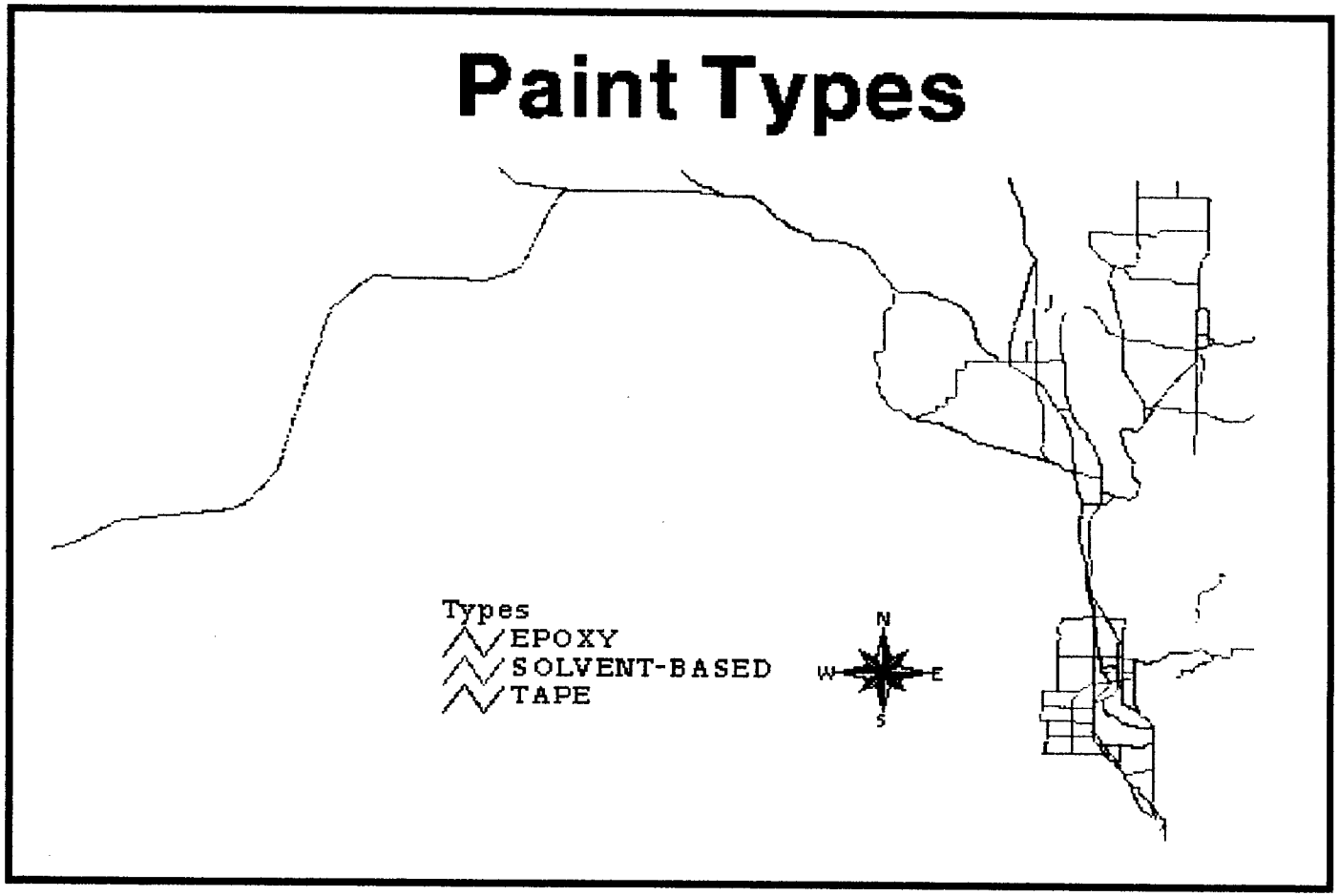


Exhibit 1. GIS Display of the Three Paint Types: Epoxy, Solvent, and Tape.

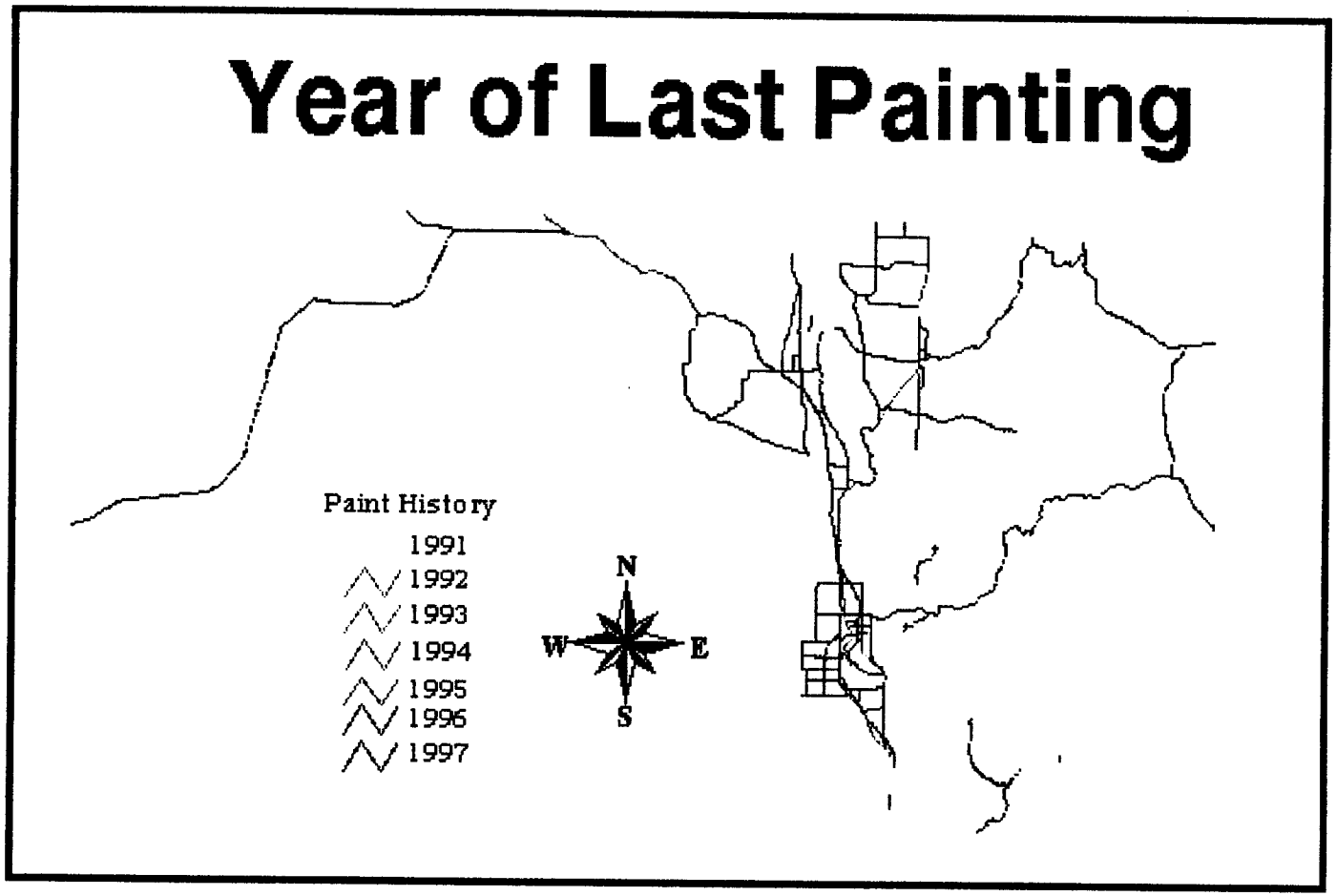


Exhibit 2. GIS Display of the Painting History.

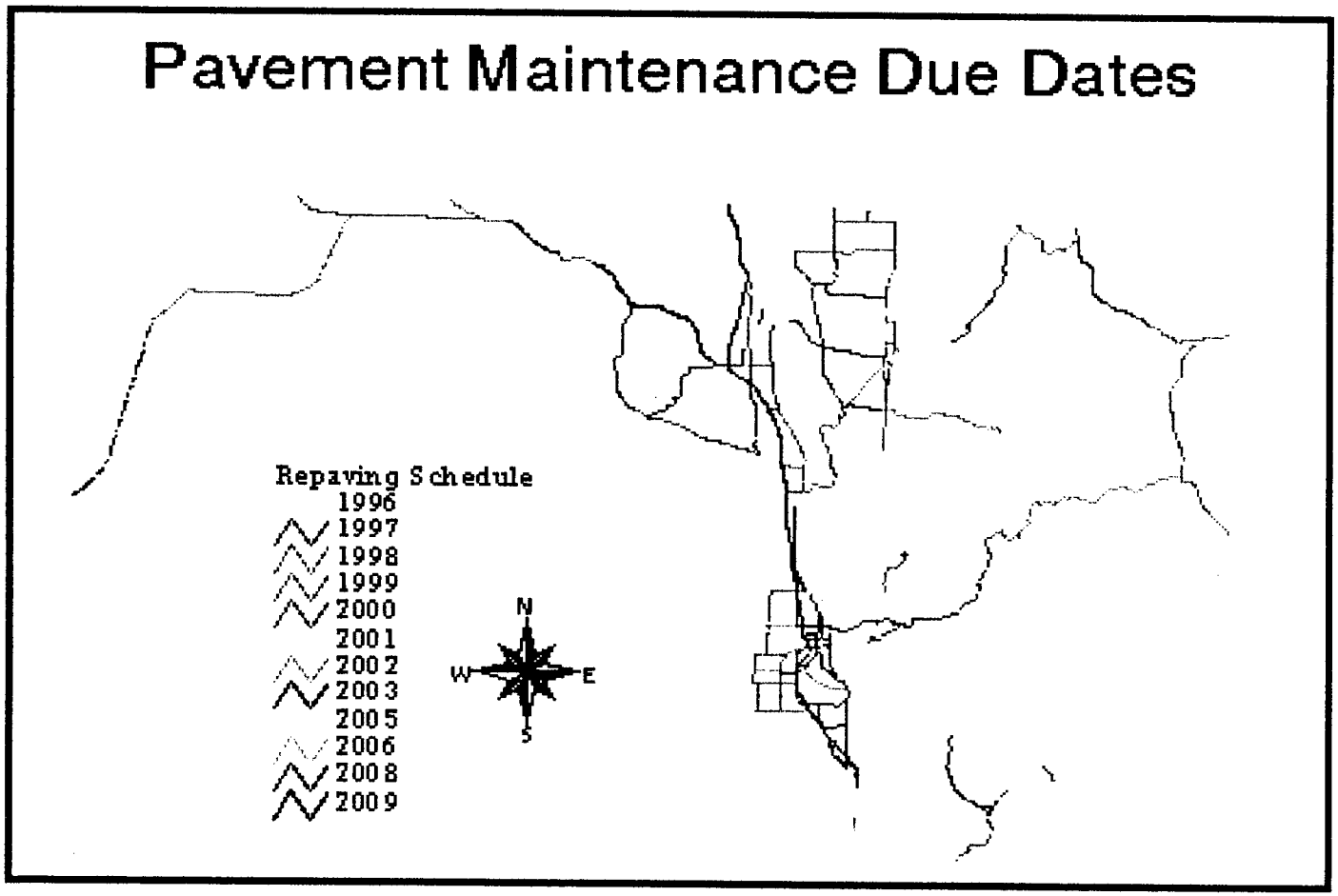


Exhibit 3. GIS Display of the next Scheduled Maintenance.

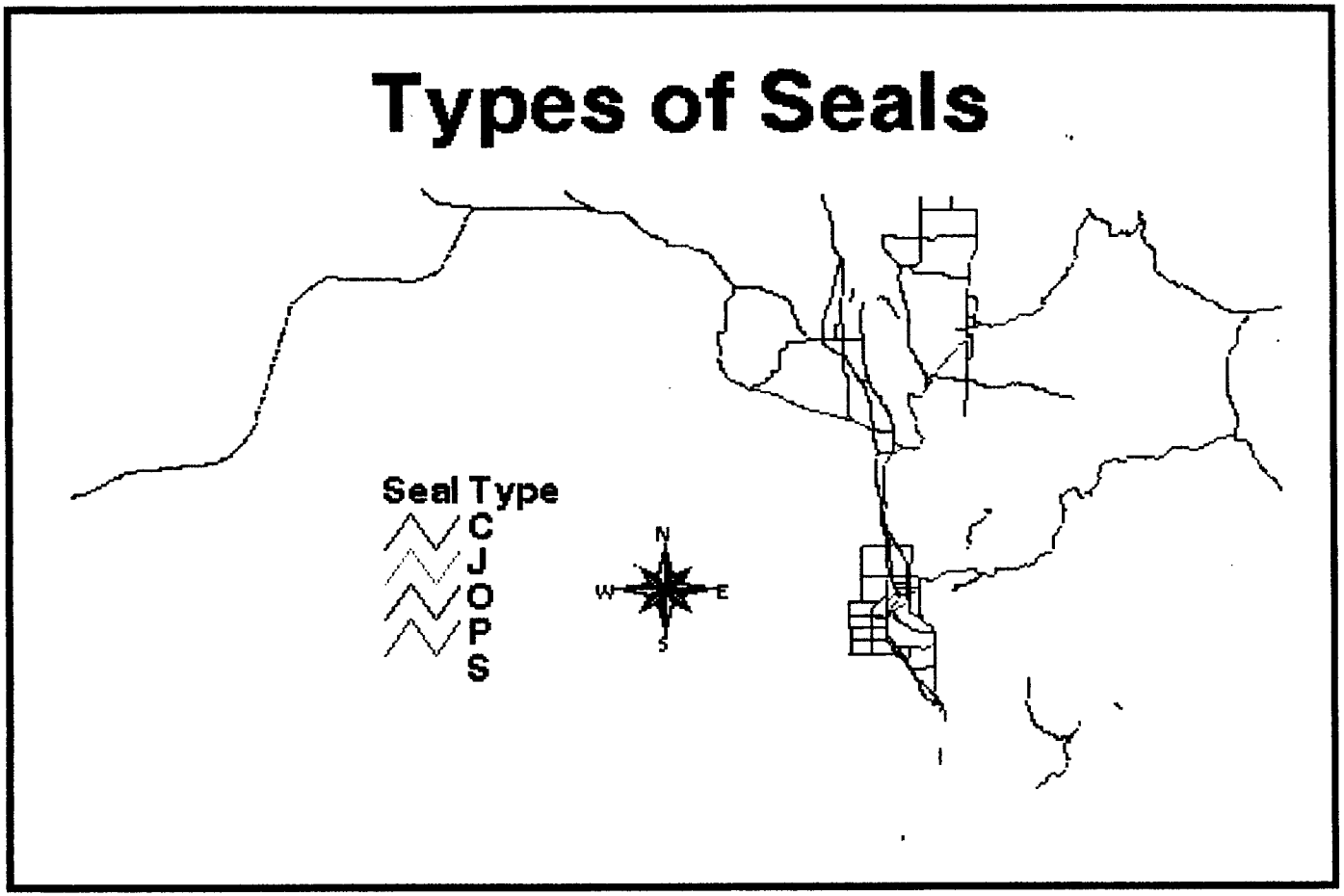


Exhibit 4. GIS Display of the Types of Seals.

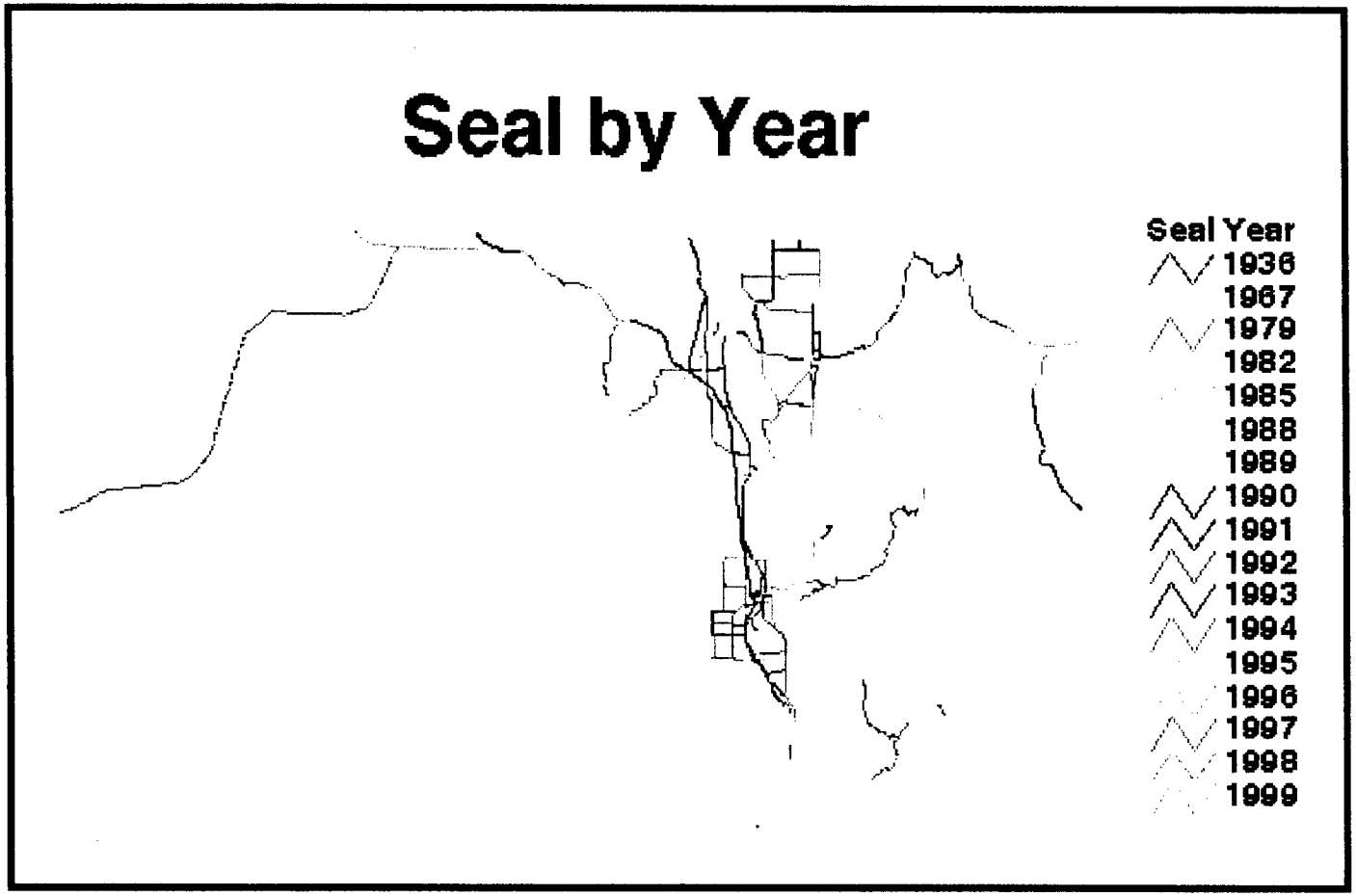


Exhibit 5. GIS Display of the Seal Maintenance History.

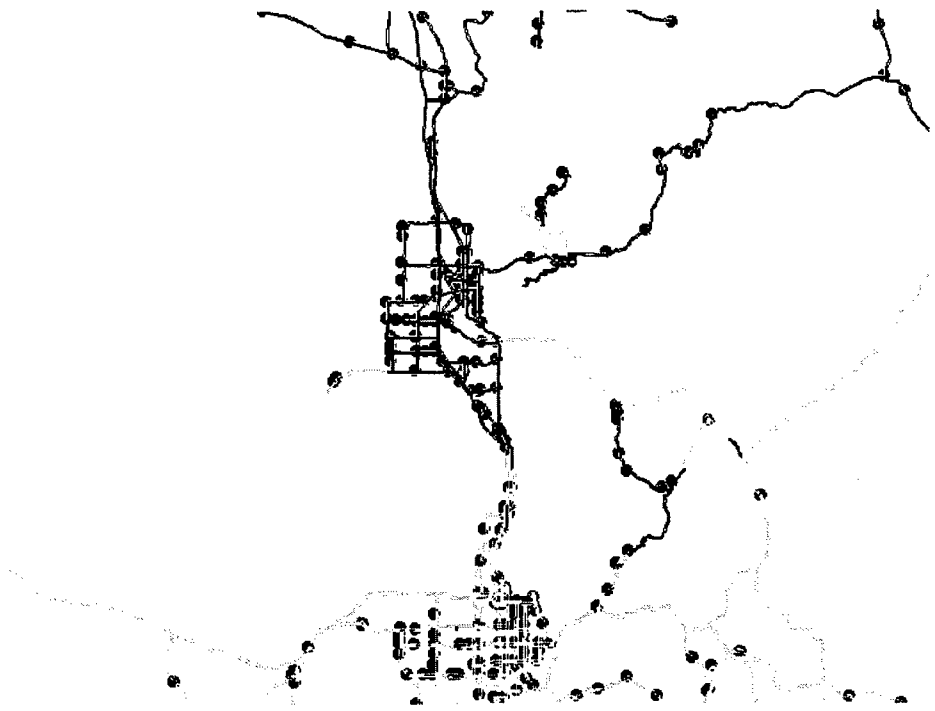


Exhibit 6. Data Overlay from Three Data Modules.

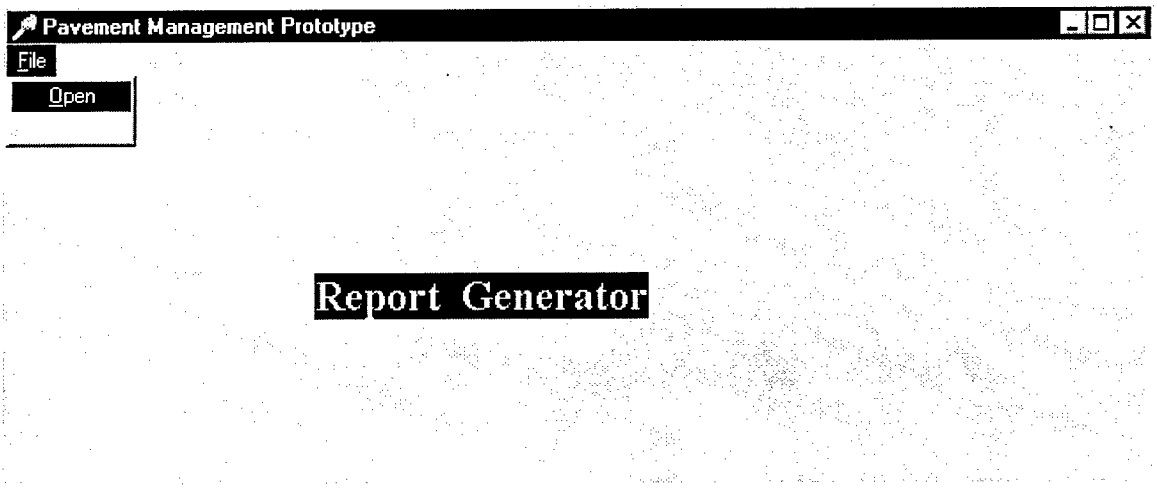
PAVEMENT MANAGEMENT ANALYSIS APPLICATION

Introduction

Figure 2 shows the process used for developing prototype data analysis application. Creation of the Standard Data module with data from the Quattro Pro spreadsheet was described in the previous section, where it was used for a GIS application. In this section, the same data module will be used to create charts, graphs, and tables with a custom interface, the "Report Generator." The Report Generator provides the user with a tool to quickly and easily analyze and display information about the data from the data module. It displays:

- types of surface treatments by percentage
- historical and planned future surface treatments by year
- number of miles treated, cumulatively, and by percent

The screen shot below shows the opening screen.



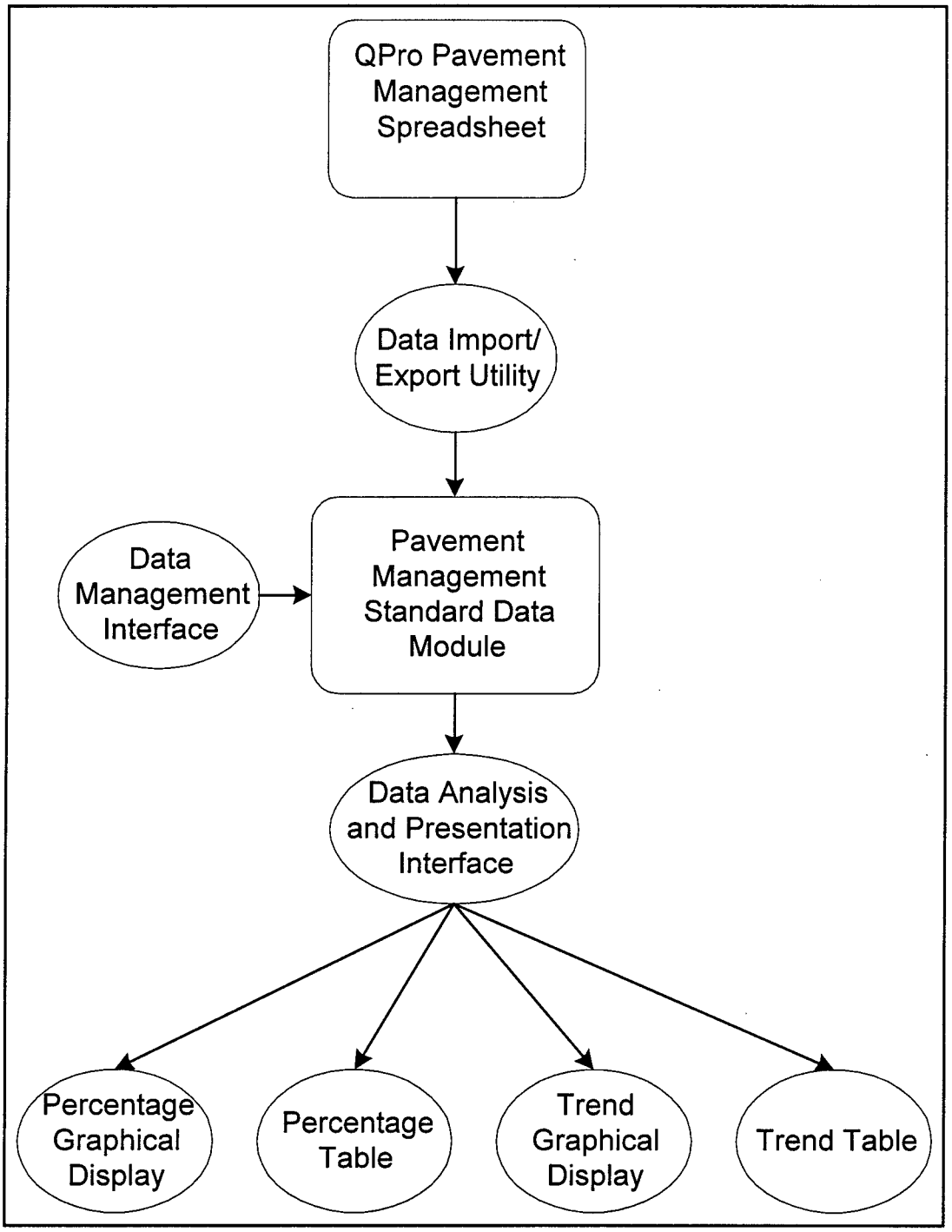
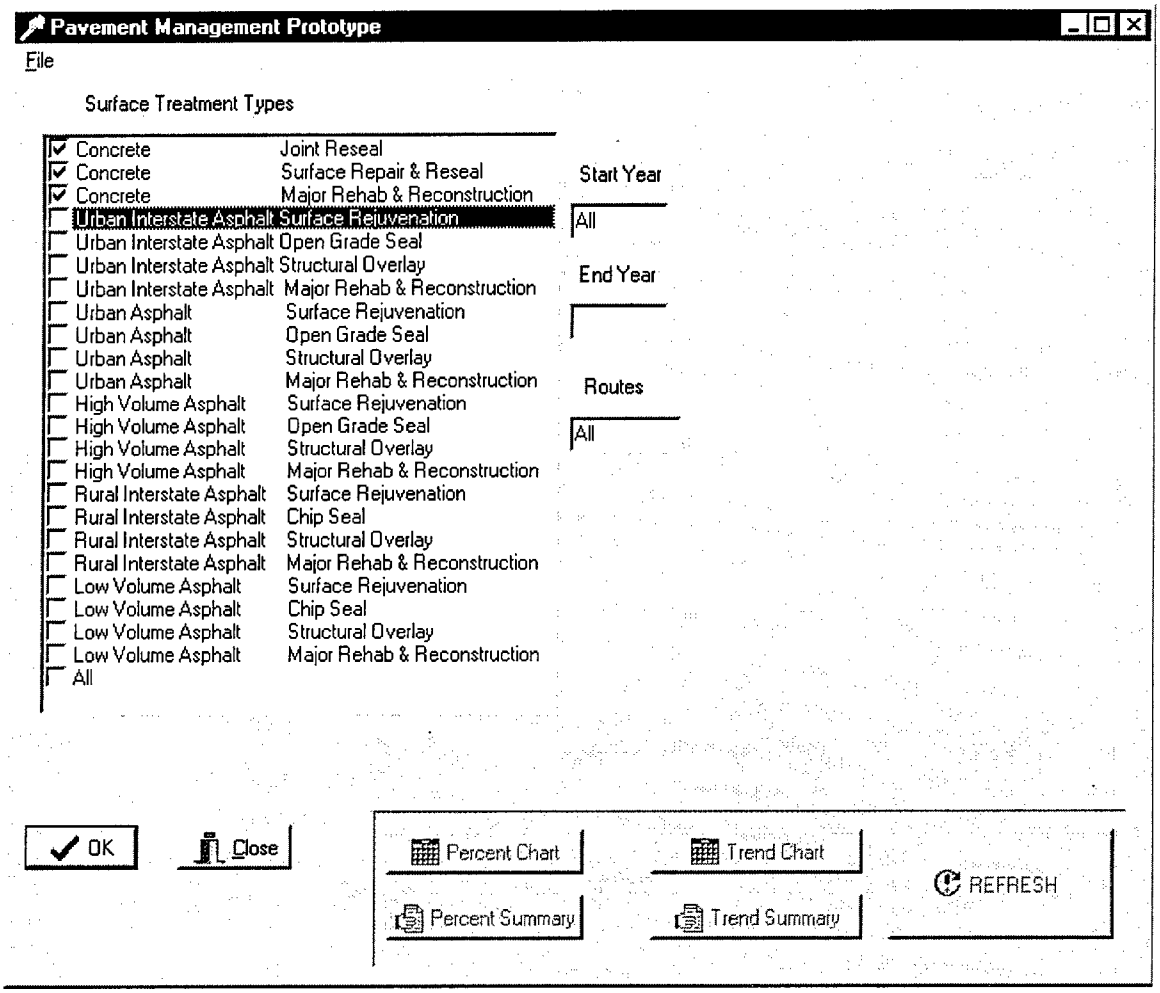


Figure 2. Prototype Pavement Management Data Analysis Application

Click on the File/Open menu. When prompted for the dBase file, choose the Pavement Management File. The following screen will open.



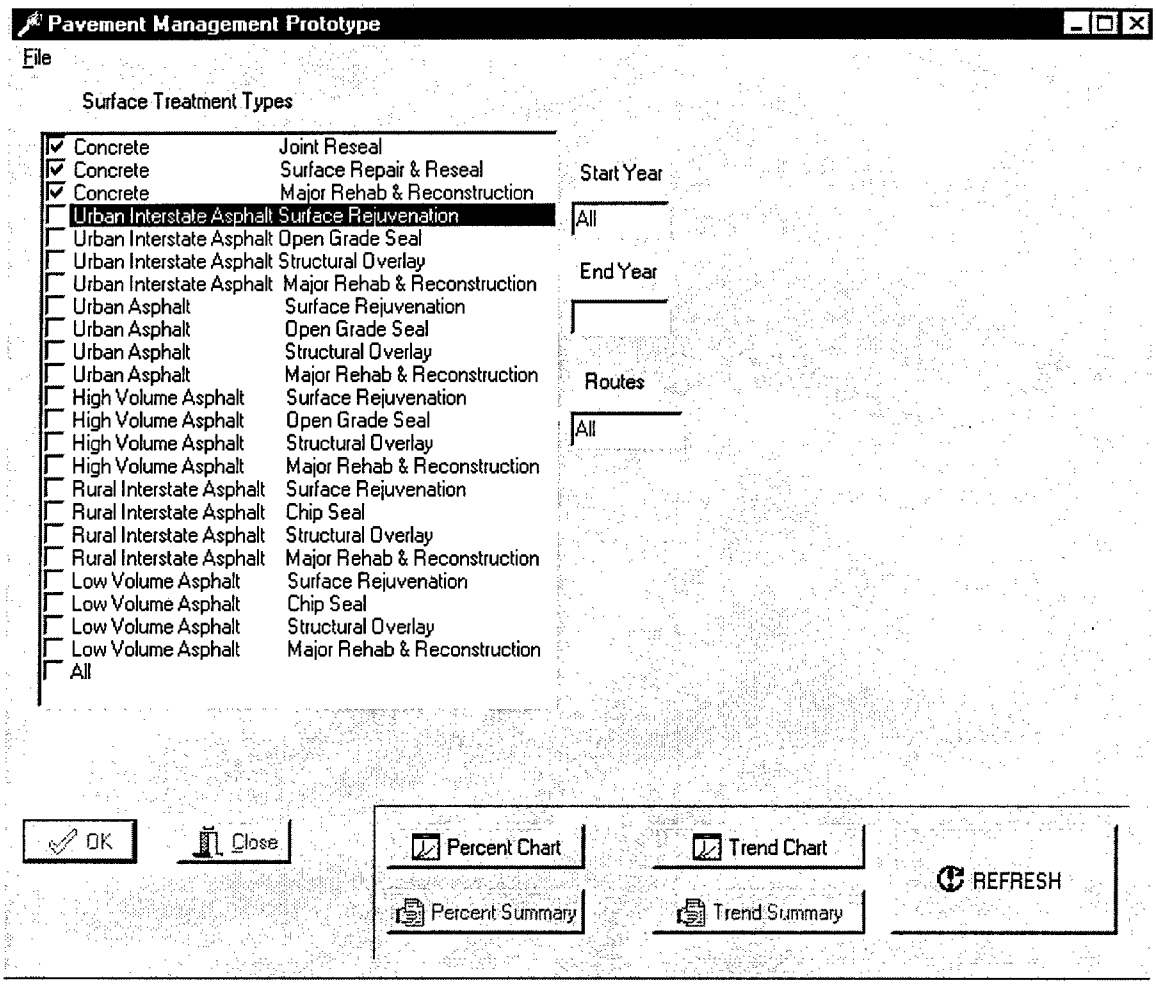
Check the box for Surface Treatment Types and choose the desired Treatment types. Enter a Start Year, End Year, and a Route. The values will default to "All" if nothing is entered.

Click the "OK" button after the above process has been completed.

Clicking on the "OK" button enables other buttons namely "Percent Chart," "Trend Chart," and the "Refresh" button. Clicking on the "Percent Chart" brings up a Pie diagram, "Trend Chart" brings up a Bar Diagram and the "Refresh" button is used to repeat the process.

Percent Chart

Clicking the "Percent Chart" button produces two changes. The Pie chart is displayed and the "Percent Summary" button is enabled. The Pie Chart displays the treatment types as a percentage of total treated miles.



The next pie chart shows treatment types as a percentage of the total treated miles.

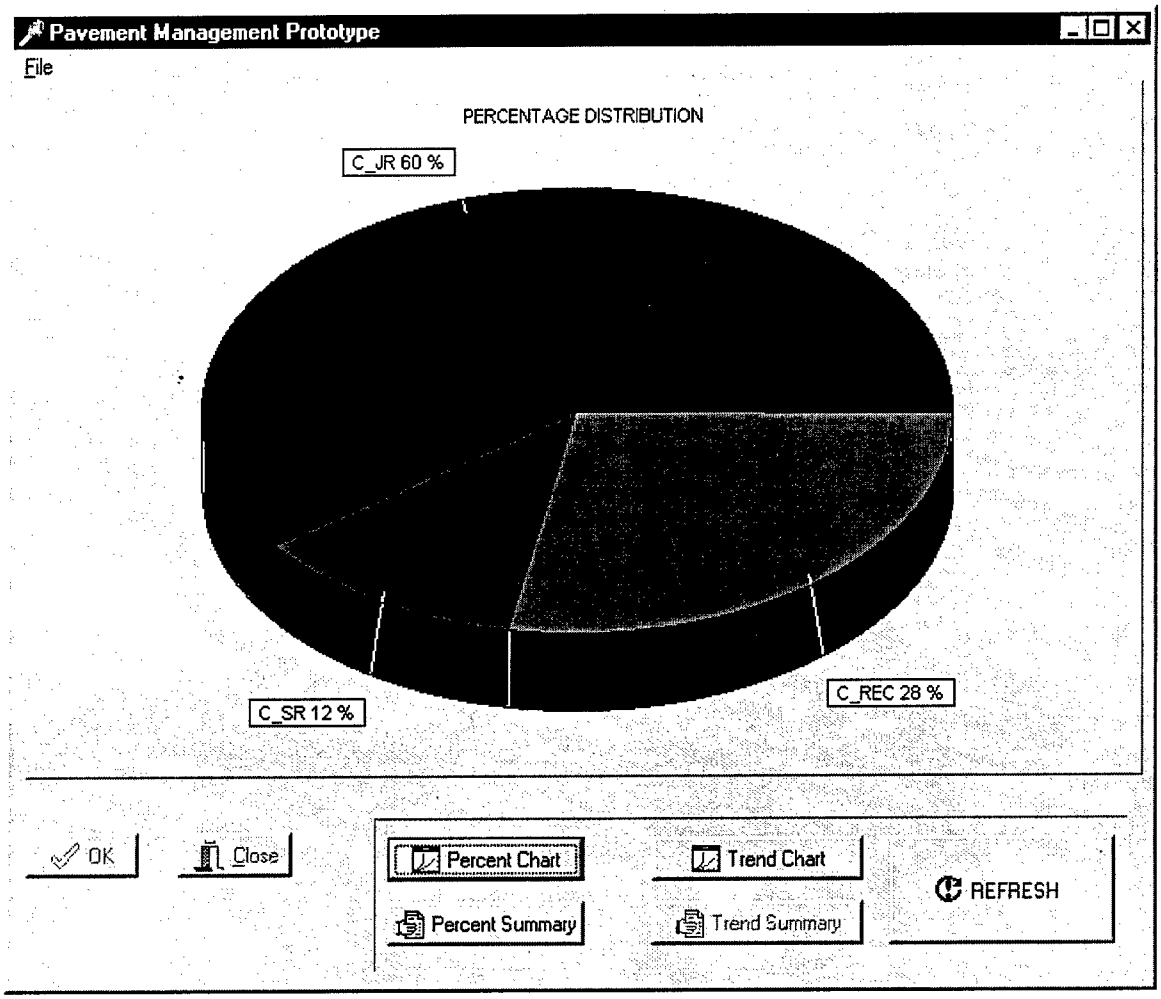


Exhibit 7. Pie Chart of the Percentage of Different Treatment Types

Percent Summary

Click on the "Percent Summary" button.

A table appears, which summarizes treatment types, route, years selected, and miles treated.

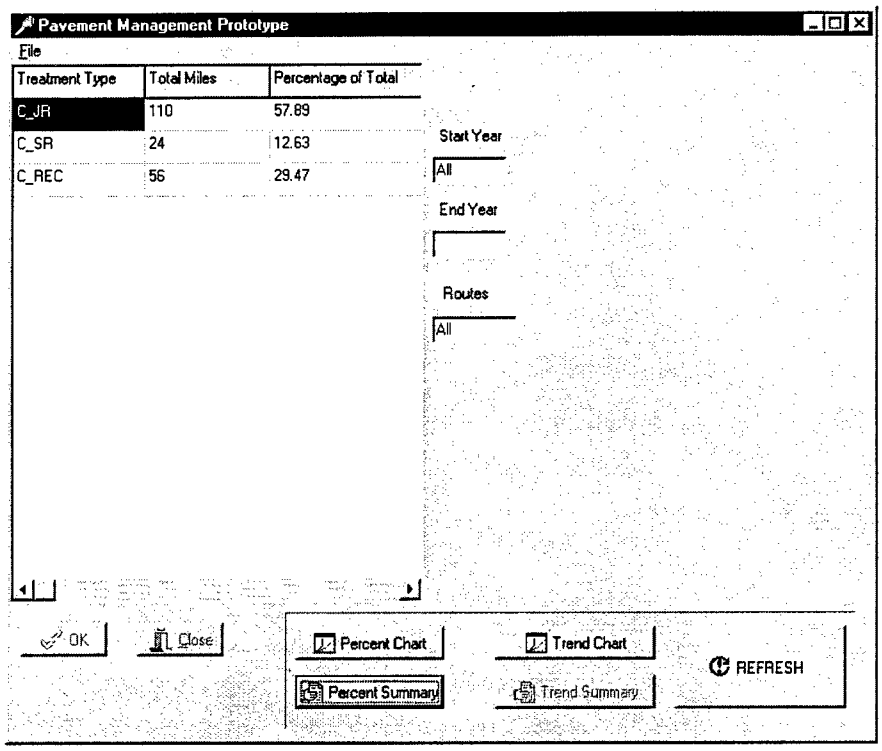


Exhibit 8. Table of the Percentage of Different Treatment Types

Trend Chart

Clicking on the "Trend Chart" button brings into view a bar chart. The bar chart details number of miles treated chronologically for distinct treatment types as shown in the following display.

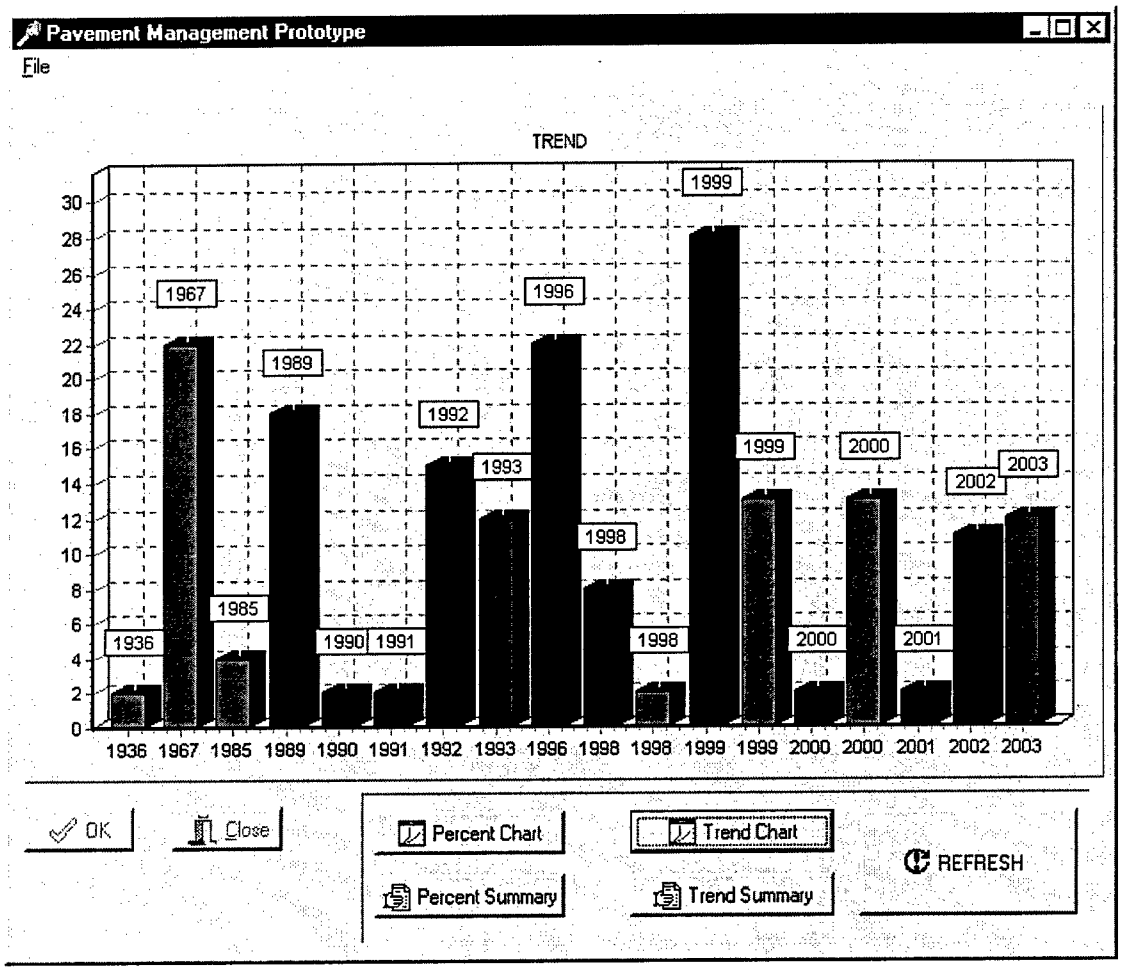


Exhibit 9. Bar Chart of the History of Three Types of Surface Treatments.

Trend Summary

Click on the "Trend Summary" button.

Trend summary is a tabular report of miles of roadway treated by a particular treatment type, in chronological order.

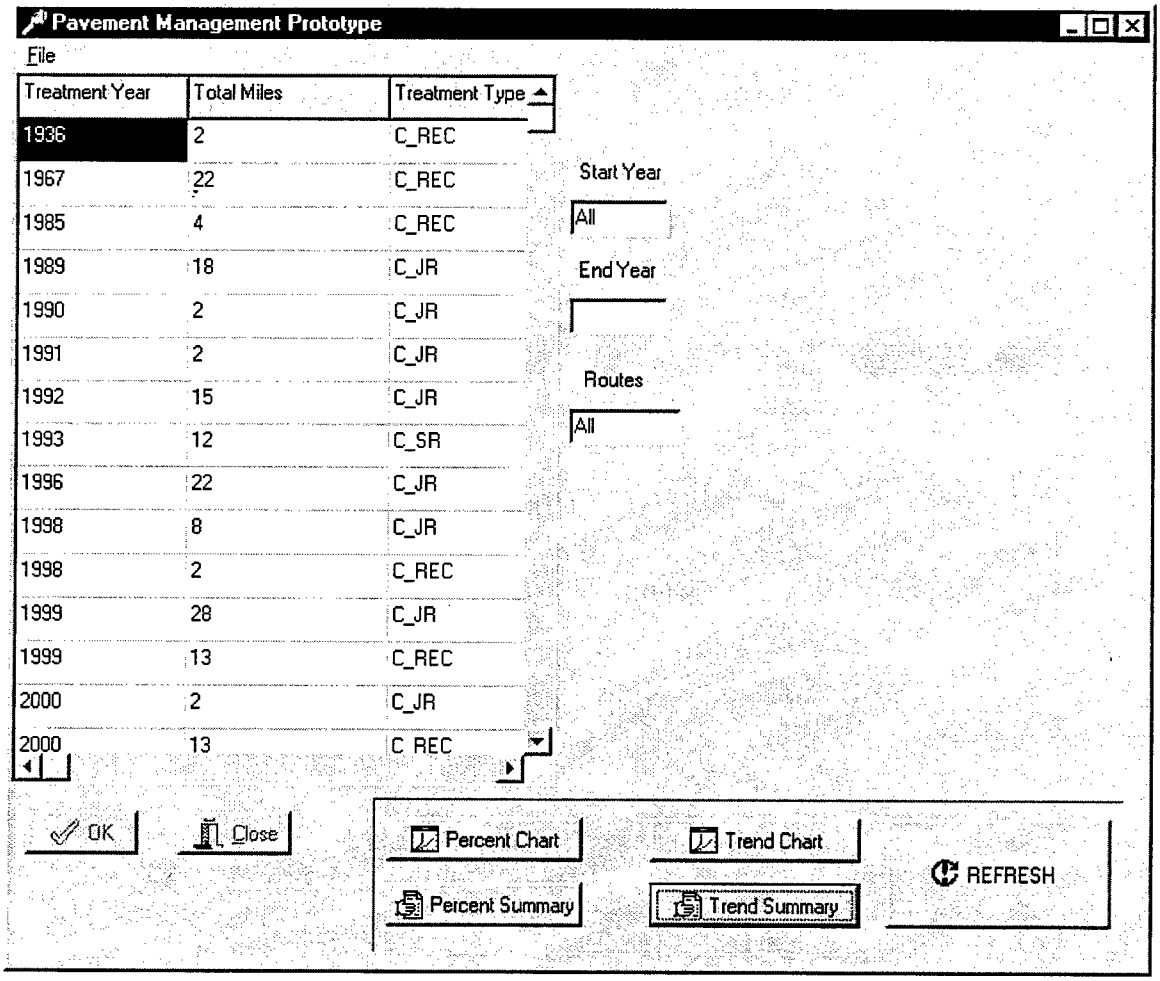


Exhibit 10. Table of the History of Three Types of Surface Treatments.

Refresh or Close

Click on the "Refresh" button to produce reports for a different set of data or click the "Close" button to quit the program.

SUMMARY AND CONCLUSIONS

Different operating and management levels in transportation hierarchies have different needs for data accessibility and, therefore, different perspectives for database management systems in the agency. A natural tendency exists for upper management to want a comprehensive database system that provides direct access to agency-wide information. At the other end of the spectrum, individuals in the operating units desire specialized computer tools optimized to be fast, efficient, and user-friendly for specific tasks. The many tasks performed throughout typical transportation agencies exacerbates this incongruity between centralized accessibility and distributed efficiency.

The Utah Department of Transportation (UDOT) volunteered to participate in this study to evaluate a proposed "Standard Modular Data Storage System" that would permit use of specific data storage modules for efficient operation, and that also would be accessible for higher level data aggregation. In particular, UDOT agreed to participate in development of a pavement management prototype that would satisfy the "centralized accessibility" and "distributed efficiency" criteria. This prototype has potential for application to smaller rural transportation agencies.

This study pursued the idea of developing a "Standard Modular Data Storage System" that would provide a practical solution to this problem. The system would have the following advantages:

1. Small efficient databases still could be retained for efficient application at the operating levels.
2. The same data collected and used at the operating level would be available for an enterprise database that would give upper management access to agency-wide data.
3. Duplicate data collection and data inconsistencies would be minimized.
4. The system could be implemented incrementally with the highest priority applications first.

5. An existing obsolete application at the operating level could be replaced independently of all other applications.

6. An agency would not be locked into a multitude of proprietary vendors for a multitude of applications when it comes time for upgrades and enhancements.

The Standard Modular Data Storage System requires that all new computer applications at the operating level expose their data and conveniently export/import to the standard format.

This study demonstrates practicality of such an approach. In the case of an obsolete application — the COBOL Feature Inventory Database containing pavement data — utilities were developed to conveniently convert existing data into the standard format at periodic intervals so that the current system could continue to be used while a new system was being developed and tested. In the case of an existing independent application — the District 1 Pavement Management System — the spreadsheet data were converted to the standard format. Demonstrations were made for data management, GIS, and data analysis applications that could not have been readily accomplished in the original spreadsheet format.

A conceptual overview of the Standard Modular Data Storage System is shown in Figure 3. The five individual applications that currently conform to system are shown on the left side of the Figure. Data in the modules can be accessed and cross-linked using Power Builder, database editors, ArcView, C++, Delphi, Map Objects, or most other standard developers' tools. Additional independent applications could easily be converted and added to the series without disturbing the others.

Once data are in standard modules, they can beexported o an enterprise database as shown to the right of Figure 3. UDOT has selected Informix as its enterprise database. The standard data modules may be directly imported into Informix with a minimum of reformatting.

The conceptual model shown in Figure 3 provides maximum flexibility for expansion and enhancements. The developers' tools used for applications with data modules to the left of the Figure also work with the enterprise database on the right. At some time in the future, individuals will have the

choice between continuing to work with the individual data modules and periodically updating the enterprise system, or working directly with the enterprise system.

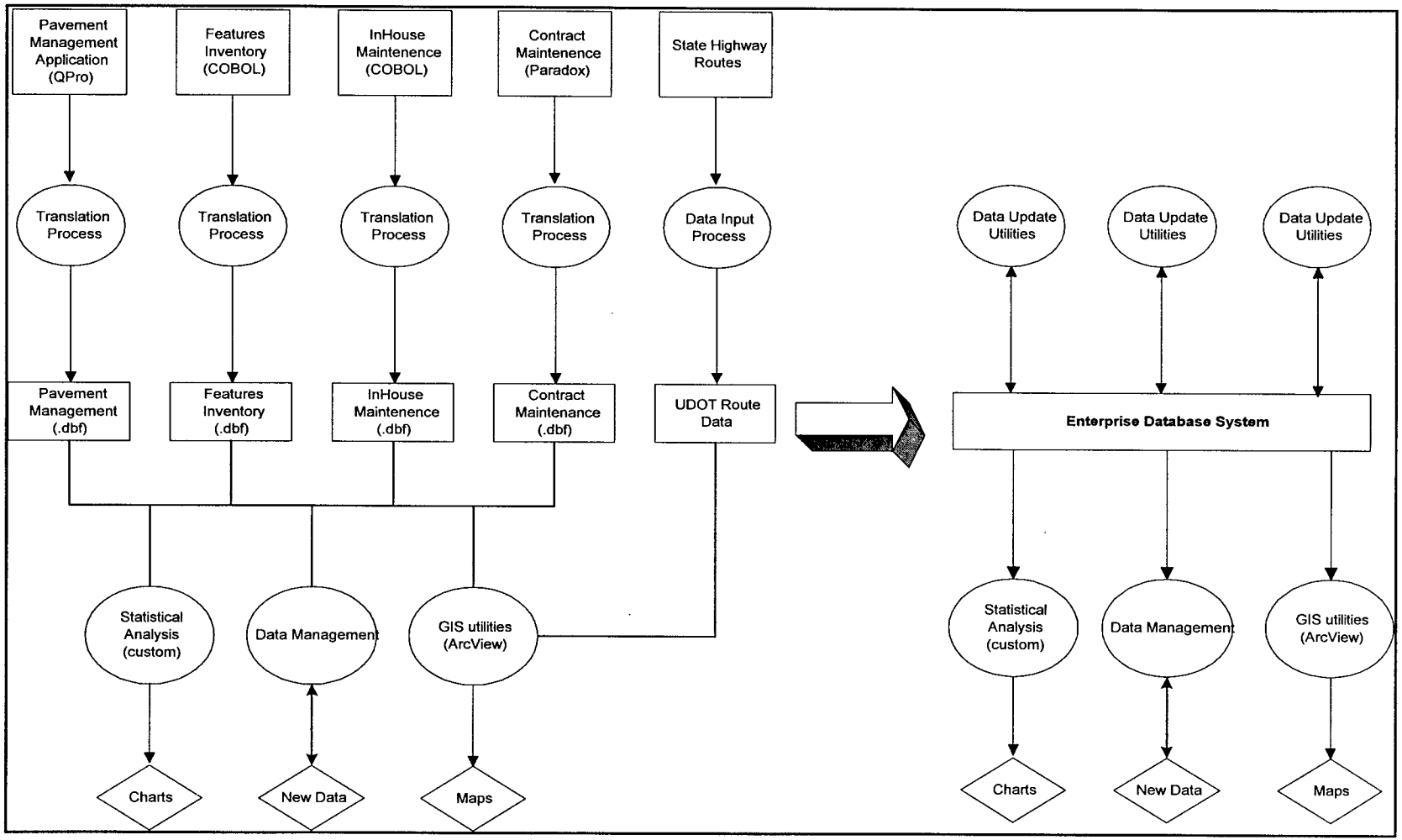


Figure 3. Conceptual Model for the Standard Modular Database System

APPENDIX A

Data Structure Formats for Pavement Management Prototype

PAVEMENT MANAGEMENT DATABASE :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	Types of Seals
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	Class of Road
PMS_new	Char	1	
Treat_type	Char	8	Types of Surface Treatments
Treat_year	Number	4	
Paint_type	Char	15	Types of Paint
Paint_date	Char	10	Calculated field
Expected_failure	Char	15	Calculated field

Types of Surface Treatments

C_JR	Concrete Joint Reseal
C_SR	Concrete Surface Repair and Reseal
C_REC	Concrete Major Rehabilitation and Reconstruction
UI_SR	Urban Interstate Asphalt Surface Rejuvenation
UI_OGS	Urban Interstate Asphalt Open Grade Seal
UI_SO	Urban Interstate Asphalt Structural Overlay
UI_REC	Urban Interstate Asphalt Major Rehabilitation and Reconstruction
UA_SR	Urban Asphalt Surface Rejuvenation
UA_OGS	Urban Asphalt Open Grade Seal
UA_SO	Urban Asphalt Structural Overlay
UA_REC	Urban Asphalt Major Rehabilitation and Reconstruction
HV_SR	High Volume Asphalt Surface Rejuvenation
HV_OGS	High Volume Asphalt Open Grade Seal
HV_SO	High Volume Asphalt Structural Overlay
HV_REC	High Volume Asphalt Major Rehabilitation and Reconstruction
RI_SR	Rural Interstate Asphalt Surface Rejuvenetion
RI_CS	Rural Interstate Asphalt Chip Seal
RI_SO	Rural Interstate Asphalt Structural Overlay
RI_REC	Rural Interstate Asphalt Major Rehabilitation and Reconstruction
LV_SR	Low Volume Asphalt Surface Rejuvenation
LV_CS	Low Volume Asphalt Chip Seal
LV_SO	Low Volume Asphalt Structural Overlay
LV_REC	Low Volume Asphalt Major Rehabilitation and Reconstruction

Types of Paint
Solvent-based
Epoxy
Tape

Class of Road

Rural	Rural Roads
Urban	Urban Roads

Types of Seals

C: Chip Seal	P: Plant Mix Seal
O: Concrete	S: Slurry Seal

HISTORY SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat_type	Char	8	
Treat_year	Number	4	

PAINT HISTORY SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Paint_type	Char	8	
Paint_date	Char	9	

CONCRETE SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

C_JR	JOINT RESEAL
C_SR	SURFACE REPAIR AND RESEAL
C_REC	MAJOR REHABILITATION AND RECONSTRUCTION

URBAN INTERSTATE ASPHALT SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

UI_SR	SURFACE REJUVENATION
UI_OGS	OPEN GRADE SEAL
UI_SO	STRUCTURAL OVERLAY
UI_REC	RECONSTRUCTION

URBAN ASPHALT SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

UA_SR	SURFACE REJUVENATION
UA_OGS	OPEN GRADE SEAL
UA_SO	STRUCTURAL OVERLAY
UA_REC	RECONSTRUCTION AND REHABILATION

HIGH VOLUME ASPHALT SUMMARY :

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

HV_SR	SURFACE REJUVENATION
HV_OGS	OPEN GRADE SEAL
HV_SO	STRUCTURAL OVERLAY
HV_REC	RECONSTRUCTION & REHABILITATION

RURAL INTERSTATE SUMMARY:

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

RI_SR	SURFACE REJUVENATION
RI_CS	CHIP SEAL
RI_SO	STRUCTURAL OVERLAY
RI_REC	RECONSTRUCTION

LOW VOLUME ASPHALT SUMMARY:

Field	Type	Size	Description
Station	Number	3	
Route	Number	3	
Begin_MP	Number	6	Beginning Milepoint
Ending_MP	Number	6	Ending Milepoint
Location_des	Char	20	
A.D.T.	Number	8	Average Daily Traffic
Surface Area	Number	5	
Seal	Char	1	
Date Acc.	Number	4	
Contract_Agency	Char	10	
Road_class	Char	6	
PMS_new	Char	1	
Treat _type	Char	7	Classification of treatment type
Treat _year	Number	4	
Future_treat_type1	Char	7	Calculated field
Future_treat_year1	Number	4	Calculated field
Future_treat_type2	Char	7	Calculated field
Future_treat_year2	Number	4	Calculated field

Classification of treatment type

LV_SR	SURFACE REJUVENATION
LV_CS	CHIP SEAL
LV_SO	STRUCTURAL OVERLAY
LV_REC	RECONSTRUCTION

APPENDIX B

Data Structure Formats for Features Inventory

File Name: 100.dbf **Num Rec:** 1719 **Desc:** Stations
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Station	Char	4	Yes	Station Number
Delin_amt	Number	20	Yes	Delineator Count
Delin_type	Char	1		Delineator Material Type
Color	Char	1		

DELINEATOR MATERIAL TYPE

M	Metal
F	Flexible
T	Tabs

File Name: 110.dbf **Num Rec:** 1617 **Desc:** Counties
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
County	Number	20	Yes	County Number

County Number	
100	Beaver
300	Box Elder
500	Cache
700	Carbon
900	Daggett
1100	Davis
1300	Duchesne
1500	Emery
1700	Garfield
1900	Grand
2100	Iron
2300	Juab
2500	Kane
2700	Millard
2900	Morgan
3100	Piute
3300	Rich
3500	Salt Lake
3700	San Juan
3900	Sanpete
4100	Sevier
4300	Summit
4500	Tooele
4700	Uintah
4900	Utah
5100	Wasatch
5300	Washigton
5500	Wayne
5700	Weber

File Name: 120.dbf **Num Rec:** 1268 **Desc:** Intersecting Roads
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Name_desc	Char	30	Yes	Road Name
Inter_type	Char	1	Yes	Type of Intersection

Type of Intersection

R	Right
L	Left
B	Both

File Name: 130.dbf **Num Rec:** 1643 **Desc:** Major Structures
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
MS_no	Number	20	Yes	STRUCTURE NUMBER
MS_Length	Number	20	Yes	STRUCTURE LENGTH
MS_Width	Number	20	Yes	STRUCTURE WIDTH
MS_type	Char	2	Yes	TYPE STRUCTURE
MS_func	Char	2	Yes	STRUCTURE FUNCTION

TYPE STRUCTURE

O1	Overpass Spans One
O2	Overpass Spans Two
B1	Bridge Carries One
B2	Bridge Carries Two

STRUCTURE FUNCTION

RD	Road
RR	Railroad
WA	Water
TR	Terrain
PD	Pedestrian
UT	Utility
OT	Other

File Name: 140.dbf **Num Rec:** 937 **Desc:** CITY/TOWN LIMITS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
MS_type	Char	2	No	TYPE AREA
Name_Desc	Char	30	Yes	CITY/TOWN NAME

TYPE AREA

E	Entering City/Town
L	Leaving City/Town

File Name: 150.dbf **Num Rec:** 189 **Desc:** RAILROAD CROSSING
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
RR_xing_no	Number	20	No	CROSSING NUMBER
Name_desc	Char	30	Yes	CROSSING NAME

File Name: 170.dbf **Num Rec:** 2263 **Desc:** OTHER REFERENCE
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	No	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Name_desc	Char	30	Yes	DESCRIPTION

File Name: 310.dbf **Num Rec:** 1534 **Desc:** TYPE ACCESS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type Access
Ending_MP	Float	6.7		ENDING MILEPOINT

Type Access

C	CONTROLLED ACCESS
P	PARTIAL CONTROL
U	UNCONTROLLED ACCESS

File Name: 320.dbf **Num Rec:** 2014 **Desc:** SURFACE TYPE
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Type1	Char	2	Yes	Type Surface

TYPE SURFACE

C	CONCRETE
B	BITUMINOUS
O	OPEN GRADED
G	NON HARD (GRAVEL)

File Name: 330.dbf **Num Rec:** 5414 **Desc:** NUMBER OF LANES
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num1	Float	5.3	Yes	Number of lanes

File Name: 340.dbf **Num Rec:** 2265 **Desc:** MEDIAN WIDTH
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num4	Float	7.3	Yes	Average median width
Type1	Char	2	Yes	Type of median

TYPE OF MEDIAN

N	NO MEDIAN
P	PAINTED
R	RAISED
D	DEPRESSED

File Name: 350.dbf **Num Rec:** 7538 **Desc:** SHOULDER TYPE
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	SIDE DESIGNATOR (L,R)
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num4	Float	7.3	Yes	BITUMINOUS SHOULDER WIDTH
Type1	Char	2	Yes	Type of shoulder

TYPE SHOULDER

C	CONCRETE CURB/GUTTER
P	PAVED CURB/GUTTER
B	BIT. HARD SHOULDER
G	GRAVEL SHOULDER
N	NO SHOULDER

File Name: 360.dbf **Num Rec:** 50080 **Desc:** DRAINAGE INSTALLATIONS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	SIDE DESIGNATOR
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num1	Float	5.3	Yes	Number of tubes
Num2	Float	5.3	Yes	Number of drop inlets
Num3	Float	5.3	No	Cross drainage
Num4	Float	7.3	Yes	Size
Num5	Float	7.3	Yes	Year of installation
Type1	Char	2	Yes	Structure material
Type2	Char	2	Yes	End treatment type
Type3	Char	2	Yes	
Len1	Float	9.3	Yes	Run length (Miles)
Grade	Number	2.3		Type of Grade

SHAPE OF STRUCTURE

R	ROUND
O	OVAL
E	ELLIPTICAL
B	BOX

STRUCTURE MATERIAL

CN	CONCRETE
CR	CONCRETE REINFORCED
ST	STEEL
PL	PLASTIC
CO	CORRUGATED
W	WOOD

END TREATMENT

M	MOUNTABLE
H	HEADWALL
E	ENERGY DISSIPATER
N	NO TREATMENT

CROSS DRAINAGE

1	CROSS 1 TRAVEL LANE
2	CROSS 2 TRAVEL LANES

TYPE OF GRADE

S	STANDARD
N	NON-STANDARD

File Name: 370.dbf **Num Rec:** 9603 **Desc:** DITCH
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	SIDE DESIGNATOR
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type of ditch
Len1	Float	9.3	Yes	Run length (Feet)

TYPE DITCH

C	CUT DITCH (CANYON)
P	PAVED DITCH
O	OTHER DITCH

File Name: 380.dbf **Num Rec:** 8086 **Desc:** GUARDRAIL
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.3	Yes	BEGINNING MILEPOINT
Num1	Float	5.3	Yes	Average Height
Type1	Char	2	Yes	Type of beam
Type2	Char	2	Yes	Type of posts
Type3	Char	2	Yes	Low end treatment
Type4	Char	2	Yes	High end treatment
Len1	Float	9.3	Yes	Run Length (Feet)
End_MP	Float	6.3		ENDING MILEPOINT

TYPE OF BEAM

B	BARRIER CABLE
C	CONCRETE BARRIER
M	METAL GUARDRAIL
R	RECT. METAL BOX BEAM
K	K CONCRETE BARRIER
T	TRI BEAM

TYPE OF POST

W	WOOD
C	CONCRETE
M	METAL
N	NONE/OTHER

LOW END TREATMENT

TT	TEXAS TURN DOWN
EL	ECCENTRIC LOADER
ET	ET 2000
GR	G.R.E.A.T.
NO	NO TREATMENT
OT	OTHER
CA	C.A.T.
GL	GRAVEL
TR	TREND
MT	MOUNTED

HIGH END TREATMENT

TT	TEXAS TURN DOWN
EL	ECCENTRIC LOADER

ET	ET 2000
GR	G.R.E.A.T.
NO	NO TREATMENT
OT	OTHER
CA	C.A.T.
GL	GRAVEL
TR	TREND
MT	MOUNTED

File Name: 390.dbf **Num Rec:** 3996 **Desc:** RIGHT-OF-WAY FENCE
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num4	Float	7.3	Yes	HEIGHT OF FENCE (INCHES)
Type1	Char	2	Yes	Type of fence
End_MP	Char	6.2		ENDING MILEPOINT
Offset	Number	7.3		Average offset from the road
Post	Char	1		Type of post

TYPE OF FENCE

FD	FIELD
CL	CHAIN LINK
MI	MISCELLANEOUS
NO	NO FENCE
WL	WILDLIFE

TYPE OF POST

W	WOOD
C	CONCRETE
O	OTHER
M	METAL

File Name: 400.dbf **Num Rec:** 226 **Desc:** SNOW FENCE
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Type1	Char	2	Yes	Type of fence
Len1	Float	9.3	Yes	Run Length (Feet)

TYPE OF FENCE

T	TEMPORARY SNOW FENCE
P	PERMANENT SNOW FENCE

File Name: 410.dbf **Num Rec:** 40894 **Desc:** SIGNS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num1	Float	5.3	No	Sign count AT GRADE
Num2	Float	5.3	No	Sign count overhead
Num4	Float	7.3	Yes	
Num5	Float	7.3	Yes	

File Name: 420.dbf **Num Rec:** 456 **Desc:** CRASH ATTENUATORS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type of attenuator

TYPE ATTENUATOR

SB	SAND BARRELS
OT	OTHER

File Name: 430.dbf **Num Rec:** 92 **Desc:** WALLS
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num1	Float	5.3	Yes	Average height
Type1	Char	2	Yes	Type of wall
Type2	Char	2	Yes	Type of material
Len1	Float	9.3	Yes	Run Length (Feet)

TYPE WALL

LB	LIGHT BARRIER
SB	SOUND BARRIER
BW	BIN WALL
E1	EARTHEN 1 WALL
E2	EARTHEN 2 WALLS
E3	EARTHEN 3/MORE WALLS

TYPE MATERIAL

C	CONCRETE
W	WOOD
O	OTHER

File Name: 450.dbf **Num Rec:** 9 **Desc:** ROAD TO OPEN
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	9.3	Yes	Ending Milepoint

File Name: 460.dbf **Num Rec:** 23201 **Desc:** PAVEMENT STRIPING
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Marking type
Type2	Char	2	Yes	Center line
Facil_Name	Char	32	Yes	Right and Left Striping
Ending_MP	Float	6.2		ENDING MILEPOINT

MARKING TYPE

P	PAINT
E	EPOXY
T	TAPE
O	OTHER DURABLE
W	WATERBORNE
NL	NO LINE

CENTER LINE

4K	4" SKIP
4S	4" SOLID
8K	8" SKIP
8S	8" SOLID
NP	NO PASS LANE
PR	PASS RIGHT LANE
PL	PASS LEFT LANE
NL	NO LINE

RIGHT 1 - 8

4K	4" SKIP
4S	4" SOLID
8K	8" SKIP
8S	8" SOLID
NP	NO PASS LANE
PR	PASS RIGHT LANE
PL	PASS LEFT LANE
NL	NO LINE

LEFT 1 - 8

4K	4" SKIP
4S	4" SOLID
8K	8" SKIP

8S	8" SOLID
NP	NO PASS LANE
PR	PASS RIGHT LANE
PL	PASS LEFT LANE
NL	NO LINE

File Name: 470.dbf **Num Rec:** 7739 **Desc:** PAVEMENT MESSAGES
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num1	Float	5.3	Yes	
Type1	Char	2	Yes	Message
Paint type	Char	10		

MESSAGE	
EX	EXIT ONLY
OT	OTHER
RR	RAILROAD CROSSING
SC	SCHOOL/PED. CROSSING
SP	SPEED
ST	STOP AHEAD
TA	TURN ARROW

File Name: 480.dbf **Num Rec:** 626 **Desc:** MEDIAN CROSS OVER
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT

File Name: 490.dbf **Num Rec:** 8306 **Desc:** RIGHT-OF-WAY
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num4	Float	7.3	Yes	Right of way width

File Name: 500.dbf **Num Rec:** 4915 **Desc:** VEGETATION MANAGEMENT
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num4	Float	7.3	Yes	Veg mangmt width
Type1	Char	2	Yes	Type of vegetation
Len1	Float	9.3	Yes	Run Length (Feet)

TYPE VEGETATION

WE	WEEDS (MOWABLE AREA)
WF	WILDFLOWERS
LA	LANDSCAPE
TI	TREES (IRRIGATED)
SI	SHRUBS (IRRIGATED)

File Name: 510.dbf **Num Rec:** 8081 **Desc:** PAVEMENT WIDTH
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num4	Float	7.3	Yes	Pavment Width
Ending_MP	Float	6.2		ENDING MILEPOINT

File Name: 520.dbf **Num Rec:** 8764 **Desc:** MOWABLE WIDTH
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Num4	Float	7.3	Yes	Mowable width

File Name: 700.dbf **Num Rec:** 654 **Desc:** TRAFFIC ISLANDS
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num4	Float	7.3	Yes	Average width
Len1	Float	9.3	Yes	Run Length (Feet)
Desc	Char	2		

File Name: 710.dbf **Num Rec:** 3310 **Desc:** LITTER PICKUP
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type of pickup
Acreage	Float	5.3		
Ending_MP	Float	6.2		ENDING MILEPOINT

TYPE OF PICKUP

L	LITTER PICKUP
N	NO LITTER PICKUP

File Name: 720.dbf **Num Rec:** 875 **Desc:** CATTLE GUARDS
Rep: Point

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type cattle guard
Material type	Char	1		Material of Cattle Guard

TYPE CATTLE GUARD

MX	METAL ACROSS RDWAY
PT	PIT TYPE

MATERIAL OF CATTLE GUARD

M	Metal
W	Wood
O	Other

File Name: 730.dbf **Num Rec:** 294 **Desc:** PLOWABLE MARKERS
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Type1	Char	2	No	Type section
Len1	Float	9.3	Yes	Run Length (Miles)

File Name: 750.dbf **Num Rec:** 66 **Desc:** SNOW FLAGS
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Ending_MP	Float	6.2		ENDING MILEPOINT
Len1	Float	9.3	Yes	Run Length (Miles)

File Name: 760.dbf **Num Rec:** 412 **Desc:** OTHER FACILITIES
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	Yes	
Ramp_sec	Number	1	Yes	
Ramp_Ter	Number	1	Yes	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Type1	Char	2	Yes	Type section
Len1	Float	9.3	Yes	Run Length (Feet)
Len2	Float	9.3	Yes	Snow length
Len3	Float	9.3	Yes	Field length
Len4	Float	9.3	Yes	Miss. length
Len5	Float	9.3	Yes	Paved length
Len6	Float	9.3	Yes	Concrete length
Len7	Float	9.3	Yes	Surface area
Facil_Name	Char	32	Yes	Facility name

TYPE FACILITY

PK	PARK AND RIDE
PR	PORT OF ENTRY
RA	REST AREA
VA	VIEW AREA
ST	STATION
SS	SUB-STATION
WC	WELCOME CENTER
TR	RUN AWAY TRUCK LANE
BT	BRAKE TEST

File Name: 770.dbf **Num Rec:** 1 **Desc:** ROAD CONDITION
Rep: Linear

Field	Type	Size	Data	Desc
Route	Number	3	Yes	
Direction	Char	1	Yes	
Ramp_Base	Number	4	No	
Ramp_sec	Number	1	No	
Ramp_Ter	Number	1	No	
Side	Char	1	Yes	
Element	Number	3	Yes	
Begin_MP	Float	6.2	Yes	BEGINNING MILEPOINT
Num1	Float	5.3	Yes	Condition Index

APPENDIX C

Feature Inventory File Names, Types, and Sizes

Table A1 contains a list of the individual data files created from the COBOL Feature Inventory System, including their names, types, and sizes.

File Name: The file name is determined by the identification code of the feature that it contains.

File Type: DBF is the standard dBase file storing the attribute information of the features.
SHP is an ArcView file storing feature geometry.
SHX is an ArcView file storing the index of the feature geometry

Table C1. Data files created from the COBOL Feature Inventory System.

File Name	File Type	File Size (bytes)	Description
100.dbf	DBF	237,608	Stations
110.dbf	DBF	213,734	Counties
120.dbf	DBF	181,646	Intersecting Roads
130.dbf	DBF	268,227	Major Structures
140.dbf	DBF	135,250	City/Town Limits
150.dbf	DBF	28,483	Railroad Crossing
170.dbf	DBF	321,636	Other Reference
300.dbf	DBF	89,546	
310.dbf	DBF	205,878	Type Access
320.dbf	DBF	270,198	Surface Type
330.dbf	DBF	823,250	Number of Lanes
340.dbf	DBF	349,164	Median Width
350.dbf	DBF	1,168,776	Shoulder Type
360.dbf	DBF	13,021,442	Drainage Installations
370.dbf	DBF	1,488,851	Ditches
380.dbf	DBF	1,464,080	Guardrails
390.dbf	DBF	703,746	Right-of-way Fence
400.dbf	DBF	35,416	Snow Fence
410.dbf	DBF	7,034,122	Signs
420.dbf	DBF	52,762	Crash Attenuators
430.dbf	DBF	16,734	Walls
450.dbf	DBF	1,266	Road to Open
460.dbf	DBF	866	Pavement Striping
470.dbf	DBF	1,060,629	Pavement Messages
480.dbf	DBF	70,370	Median Cross Over
490.dbf	DBF	1,271,172	Right-of-way
500.dbf	DBF	860,543	Vegetation Management
510.dbf	DBF	1,228,634	Pavement Width
520.dbf	DBF	1,341,246	Mowable Width
700.dbf	DBF	114,182	Traffic Islands
710.dbf	DBF	513,436	Litter Pickup
720.dbf	DBF	100,947	Cattle Guards
730.dbf	DBF	45,630	Plowable Markers
750.dbf	DBF	10,354	Snow Flags

760.dbf	DBF	127,062	Other Facilities
770.dbf	DBF	474	Road Condition
IHMdata.dbf	DBF	68,529,322	
InvDesc.dbf	DBF	48,386	
LsB.dbf	DBF	546,536	
OldOrngBK.dbf	DBF	121,192	Contract Maintenance Archive
Orange.dbf	DBF	450,898	Contract Maintenance
TempWrk.dbf	DBF	432	
TestMst.dbf	DBF	2,316,393	
utroute.dbf	DBF	32,124	
utroute2.DBF	DBF	85,938	
utroute2c.dbf	DBF	32,124	
100.shp	SHP	48,232	Stations
110.shp	SHP	45,376	Counties
120.shp	SHP	35,604	Intersecting Roads
130.shp	SHP	46,104	Major Structures
140.shp	SHP	26,336	City/Town Limits
150.shp	SHP	5,392	Railroad Crossing
170.shp	SHP	63,464	Other Reference
300.shp	SHP	657,992	
310.shp	SHP	43,052	Type Access
320.shp	SHP	788,044	Surface Type
330.shp	SHP	1,096,988	Number of Lanes
340.shp	SHP	834,532	Median Width
350.shp	SHP	1,290,832	Shoulder Type
360.shp	SHP	1,402,340	Drainage Installations
370.shp	SHP	1,072,496	Ditches
380.shp	SHP	794,472	Guardrails
390.shp	SHP	967,632	Right-of-way Fence
400.shp	SHP	29,428	Snow Fence
410.shp	SHP	1,145,132	Signs
420.shp	SHP	12,868	Crash Attenuators
430.shp	SHP	10,212	Walls
450.shp	SHP	352	Road to Open
460.shp	SHP	2,754,176	Pavement Striping
470.shp	SHP	216,792	Pavement Messages
480.shp	SHP	17,628	Median Cross Over
490.shp	SHP	1,232,524	Right-of-way
500.shp	SHP	842,216	Vegetation Management
510.shp	SHP	1,331,500	Pavement Width
520.shp	SHP	1,365,256	Mowable Width
700.shp	SHP	68,724	Traffic Islands
710.shp	SHP	917,056	Litter Pickup
720.shp	SHP	24,600	Cattle Guards
730.shp	SHP	32,020	Plowable Markers

750.shp	SHP	69,620	Snow Flags
760.shp	SHP	41,236	Other Facilities
770.shp	SHP	380	Road Condition
IHMdata.SHP	SHP	13,418,372	
Orange.SHP	SHP	26,336	
utroute.shp	SHP	638,924	
utroute2.shp	SHP	699,004	
utroute2c.shp	SHP	638,924	
100.shx	SHX	13,852	Stations
110.shx	SHX	13,036	Counties
120.shx	SHX	10,244	Intersecting Roads
130.shx	SHX	13,244	Major Structures
140.shx	SHX	7,596	City/Town Limits
150.shx	SHX	1,612	Railroad Crossing
170.shx	SHX	18,204	Other Reference
300.shx	SHX	4,796	
310.shx	SHX	12,372	Type Access
320.shx	SHX	16,212	Surface Type
330.shx	SHX	43,412	Number of Lanes
340.shx	SHX	18,220	Median Width
350.shx	SHX	60,404	Shoulder Type
360.shx	SHX	400,740	Drainage Installations
370.shx	SHX	76,924	Ditches
380.shx	SHX	64,788	Guardrails
390.shx	SHX	32,068	Right-of-way Fence
400.shx	SHX	1,908	Snow Fence
410.shx	SHX	327,252	Signs
420.shx	SHX	3,748	Crash Attenuators
430.shx	SHX	836	Walls
450.shx	SHX	172	Road to Open
460.shx	SHX	185,708	Pavement Striping
470.shx	SHX	62,012	Pavement Messages
480.shx	SHX	5,108	Median Cross Over
490.shx	SHX	66,548	Right-of-way
500.shx	SHX	39,420	Vegetation Management
510.shx	SHX	64,748	Pavement Width
520.shx	SHX	70,212	Mowable Width
700.shx	SHX	5,332	Traffic Islands
710.shx	SHX	26,580	Litter Pickup
720.shx	SHX	7,100	Cattle Guards
730.shx	SHX	2,452	Plowable Markers
750.shx	SHX	628	Snow Flags
760.shx	SHX	3,396	Other Facilities
770.shx	SHX	108	Road Condition
IHMdata.shx	SHX	3,833,892	

Orange.shx	SHX	7,596	
utroute.shx	SHX	1,908	
utroute2.shx	SHX	8,668	
utroute2c.shx	SHX	1,908	
Cobolcvr.exe	EXE	517,000	Cobol Converter – Delphi application
dbEditor.exe	EXE	690,000	dBase Editor – Delphi application
dbView.exe	EXE	690,000	dBase Viewer – Delphi Application
ChartPType1.exe	EXE	589,000	Report Generator – Delphi Application
Ptab.dfb	DBF	140,000	Pavement Management dBase file
PaveHistory.dfb	DBF	34,800Pavement Management History dBase	
135 file(s) 149,968,637 bytes			Total number of files and storage space